CURRICULUM FOR THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN

===		=====		
:	CHEMIC	CAL EN	IGINEERING	:
:	(PETRC	CHEMI	ICAL)	:
:	Effective	from	Session	:

UNDER DEVELOPMENT

:Semester System :

Prepared By

: Curriculum Development Cell :

INSTITUTE OF RESEARCH DEVELOPMENT & TRAINING, U.P., KANPUR

APPROVED BY

: BOARD OF TECHNICAL EDUCATION	:
: U.P. LUCKNOW,	:
:CORRECTED AS SYLLABUS COMMITTEE	OF:
: B.T.E. MEETING HELD ON 04.05.2	2017

STUDY AND EVALUATION SCHEME FOR THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN CHEMICAL ENGINEERING (PETROCHEMICALS) (Effective From Session)

Curriculum	Scheme of Examination									
Periods Per Week	SUBJECT	Theory Practical							Gra-	
Le Tut Dr Lab Work Tot		 Exam	ination	Sess.	Total	Examination		Sess.	Total	na Tot-
al		 Dur.	Marks	Marks	Marks 	 Dur.	Marks	Marks 	Marks	
	1.1 Foundational Communicaton	12.5	50	20	70			 		70 70
3 1 - - - 4 3 1 - - - 4	1.3 Applied Physics-I	12.5		20		- -				
4 2 4 4 10	1.4 Mechanical Operation And Solid Handling	2.5 		20	70 	3 	60 	30 	90	1 1 1 1
4 2 6	<pre> 1.5 Measuring Instrument and Measurements</pre>	2.5 	50 	20	70 	 	 	 		70
- - - - 14 14 	1.6 Workshop Practice 	 	 		 	4 	60 	30 	90 	90
18 6 - 4 14 42 	<> >	 	250 	100	350 	 	120 	60 	180	530
	Games/NCC/Socia	l and	Cultur	al Act	ivity ·	+ Diso	cipline	(15 +	10)	25
Aggregate 555										
II SEMESTER										
3 1 - - - 4 2.1 Applied Mathematics-I(B) 2.5 50 20 70 - - - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 3 1 - - 70 -										

I SEMESTER

3 1 - - - 4 2.1 Applied Mathematics-I(B) 3 1 - 4 - 8 2.2 Applied Physics-II 5 1 2 - 8 2.3 Applied Mechanics 6 - - 4 - 10 2.4 Applied Chemistry 4 - 10 - - 14 2.5 Engineering Drawing - - - - 4 - 14 2.5 Engineering Drawing - - -	2.5 2.5 2.5 2.5 3.0 2	50 50 50 50 50 250	20 20 20 20 20 100	70 70 70 70 70 	- 3 3 - 	- 40 40 - 120	- 20 20 20 - 	- 60 60 - 180	70 130 130 130 70 - 530
Games/NCC/Socia	l and (Cultur	al Acti	 vity +	- Disc	ipline Agg:	(15 · regate	+ 10)	25 555

NOTE:-

(1) Each period will be 50 minutes duration.

- (2) Each session will be of 16 weeks.
- (3) Effective teaching will be at least 14 weeks.
- (4) Remaining periods will be utilised for revision etc.
- (5) Field visit and extension lectures are to be organised and

managed

well in advance at institute level as per need.

STUDY AND EVALUATION SCHEME FOR THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN CHEMICAL ENGINEERING(PETROCHEMICALS) (Effective From Session)

III SEMESTER										
Curriculum !	Scheme of Examination									
Periods Per Week SUBJECT	Theory Practical							Gra-		
Le Tut Dr Lab Work Tot c. ori aw Shop al al	 Exam 	inatio	n Sess. Marks 	Total Marks 	===== Exam: -==== Dur.	ination Marks	Sess. Marks 	Total Marks	nd Tot- al 	
	- 2.5 2.5 2.5 2.5 -	 50 50 50 200	 20 20 20 20 80 	 70 70 70 70 280 	 3 3 	 40 60 100	 20 30 50	 - 60 90 150	 70 70 130 90 430 	
Games/NCC/Soci	al and	l Cultu	ral Act	ivity	+ Dis	cipline Agg	(15 - regate	- 10)	25 455 	
4 - - - - 4 4.1 FunctionalCommunicaton 6 2 8 16 4.2 Chemical Technology	12.5	50 50	20	70 70	-	 60	 30	 90	70 160	

-						1 - • -	1 4110012011410001114111040011	12.0	1 00		201	, 0					1 1	• I
6		2	1	8	16	4.2	Chemical Technology	2.5	50	1	20	70	3	60	30	90	16	0
5		2	1		7	4.3	Conventional & Non Conven-	2.5	50	1	20	70					7	0
		1	1	1		1	tional Source of Energy	1		1					I		1	
4		2	1	4	10	4.4	Fluid Mechanics	2.5	50	1	20	70	3	100	50	150	22	0
4		2	1		6	4.5	Process Plant Utilities	2.5	50	1	20	70					7	0
		1	1	1		1		1		1					:	:	:	
3		- -	-	2	5	4.6	Energy Conservation	2.5	50	1	20	70	3	20	10	30	10	0
	· -	-	-		 	-				- -							·	-
26	51	8 -	- 1	14	 48	<	TOTAL>		300		120	420		180	90	270	69	0
	· -	-	-		 	-				- -							·	-
							Games/NCC/Socia	l and	Cult	url	l Activ	rity +	Disci	ipline	(15 +	10)	2	5
																		-
															Aggree	gate	71	5

NOTE:- (1) Each period will be 50 minutes duration.								
	(2)	Each session will be of 16 weeks.						
	(3)	Effective teaching will be at least 14 weeks.						
	(4)	Remaining periods will be utilised for revision etc.						
	(5)	Field visit and extension lectures are to be organised and						
managed								
-		well in advance at institute level as per need.						
	(6)	4 weeks structured and supervised, branch specific, task						
oriented								
		Industrial/field exposure to be organised during summer						
vacation.								
		Student will submit a report. There will be 150 marks						
for this		-						
		exposure. These marks will be awarded by project examiner						
in the								
		VI Sem. (Examination Marks : 100, Sessional Marks :						
50). (See	Annı	uxure-I)						

STUDY AND EVALUATION SCHEME FOR THREE YEAR (SIX SEMESTER) DIPLOMA COURSE IN CHEMICAL ENGINEERING(PETROCHEMICALS) (Effective From Session)

V SEMESTER													
Curric	ulum			!	Scheme of Examination								
Periods P	er We	eek		SUBJECT			Theory			Prac	tical		 Gra-
Le Tut Dr c. ori aw	Lab	Work Shop	Tot al		 Exam: 	inatior	n Sess. Marks	Total Marks	 Exam: 	ination	Sess. Marks	Total Marks	nd Tot- al
al 	 	 	 	ı 	Dur.	Marks 		 	Dur.	Marks 	 	 	
- - - 6 2	 4 	 – 	 4 8	 5.1 IntegrativeCommunicaton 5.2 Industrial Management and	 2.5 2.5	 50	 20	 70	 3 	 40 	 20 	 60 	 60 70
5 1 5 1 4 1	3 3 	 	9 9 5	 5.3 Heat Transfer Operations 5.4 Mass Transfer Operations 5.5 Pollution Control & Indust- 	2.5 2.5	70 70 70	30 30 30	100 100 100	- 4 _ 	100 	50 	150 	250 100 100
5 1 -	 -	–	 6	<pre>rial Safety 5.6 Petroleum Refining</pre>	 2.5	70	30	100	 	 –	 -	 –	 100
25 6 -	 10		 41	TOTAL>		 330	140	470			 70	 210	 680
	Games/NCC/Social and Culturl Activity + Discipline (15 + 10) 25											25	
											Aggree	gate	 705
VI SEMES	TER												
5 1 6 2 4 2	 6 	 	6 14 6	<pre> 6.1 Chemical Reaction Engineeri: 6.2 Automatic Process Control 6.3 Process Equipment Design</pre>	ng2.5 2.5 2.5	70 70 70	30 30 30	100 100 100	 4 	 100 	 50 	 150 	100 250 100
5 1 -	4	- 10	10 10	<pre> 6.4 Petrochemicals 6.5 Project</pre>	2.5 	70 	30 	100 	4	80 	40 	120 	220
	 	 	 	A- Equipment Design Project B- Field Exposure	- -	– –	-		- -	100 80	50 40	150 120	150 120
20 6	110	10	46	<total></total>		280	120	400		360	180	540	940
1 1	1	I	1	Games/NCC/Socia	l and	Cultur	al Acti	Lvity ·	+ Diso	cipline	(15 -	+ 10)	25
											Aggree	gate	965
NOTE : -	(1) (2)	Each Each	per: ses:	iod will be 50 minutes duration. sion will be of 16 weeks.	1			30% 70% 100%	of I of I of V	& II S II & IV & VI S	emeste: Semest emeste:	r ter r	333 819 1670
	(3) (4) (5)	Rema	inin d vi:	g periods will be utilised for rest and extension lectures at in	evisio stitu	on etc. te leve	el as pe	er		G	rand To	otal	2822

need be organised.

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MAIN FEATURES OF THE CURRICULUM

1.	Title of the Course	:	Diploma in Chemical Engineering Spl. In Petrochemicals
2.	Duration of the Course	:	Three Years Duration (Six Semester)
3.	Type of the Course	:	Full Time Institutional
4.	Pattern of the Course	:	Semester System
5.	Intake	:	60
6.	Entry Qualification	:	Passed High School with 35% Marks
7.	Admission Criteria	:	State Joint Entrance Examination

LIST OF EXPERTS

List of experts whose deliberation helped the development of curriculum in Semester System for three year(Six Semester) diploma course in Chemical Engg.(Petrochemicals) at I.R.D.T. U.P., Kanpur on 31.03.15 are honourably named below -

1.	Sri F. R. Khan	Principal	G.P., Kanpur
2.	Shri D. D. Singh	H.O.D. (Chem. Engg.)	Govt. Polytechnic Badaun
3.	Shri A. K. Agarwal	Head Chem. Engg. Deptt.	Govt. Polytechnic Sutavali(J.P.Nagar)
4.	Shri R. K. Gangwar	Head	Govt. Polytechnic Mankeda(Agra)
5.	Shri A. K. Mishra	Head	Govt. Polytechnic, Kanpur
6.	Sri Durgesh Chandra	Lecturer	Govt. Poly.,Firojhabad
7.	Sri Yogesh Sharma	Lecturer	P.M.V. Poly.,Mathura
8.	Shri Lal Ji Patel	T.B.O.	I. R. D. T.,

List of experts whose deliberation helped the development of curriculum in review and revision for three year(Six Semester) diploma course in Chemical Engg.(Petro chemical) at I.R.D.T. U.P., Kanpur on 07 & 08 July 2016 and 04 and 05 August 2016are honourably named below -

1.	Shri D. D. Singh	Principal	Govt. Polytechnic Budaun
2.	Shri R. K. Srivastava	Principal	Govt. Polytechnic Balrampur
3.	Dr. Deepak Srivastava	Professor(Plastic)	H.B.T.I., Kanpur
4.	Shri Gyanesh Katiyar	Manager(Product & Engg.)	Injecto Plast Pvt. Ltd. Lohia Corp,Kanpur
5.	Shri Surendra Prasad Pal	HOD(Rubber & Plastic)	G. P., Budaun
6.	Shri U. C. Sharma	Asstt. Prof.	UIET,CSJM University Kanpur
7.	Shri Amit Mani Tripathi	Shift Engineer	Kanpur Fertilizer & Cement LTD., Panki, Kanpur
8.	Sri Durgesh Chandra	HOD(Chemical)	Govt. Poly., Firojhabad
9. 10.	Shri Sunil Kumar Shri Lal Ji Patel	Lecturer(Chem.) T.B.O.	Govt. Poly., Kanpur I. R. D. T., Kanpur

LIST OF EXPERTS

A Curriculum Workshop for Development of Curriculum on the Subject "Energy Conservation" was held on 22nd January, 2018 at NITTTR, Chandigarh. The following participated in the workshop:-

S. No.	Name, Designation and Official address
From F	ield/Industries/Institutions of Higher Learning
1.	Shri Jotinder Singh, Engineer-in-Chief(Retd.) Punjab State Power Corpn. Ltd.(PSPCL), Punjab
2.	Shri Punit Sharma, Asstt.General Manager, Electrical & Energy Management, Godrej Appliances Ltd. Mohali, Punjab
3.	Ms. Anu Singla, Associate Professor, Chitkara University, Rajpura, Punjab
4.	Shri Girish Kumar, UP New and Renewable Energy Development Authroity (UPNEDA), Lucknow, U.P.
5.	Sh. Lal Ji Patel, TBO/ CDC Officer, IRDT Kanpur, U.P.
6.	Shri Ravinder Kumar, Research Assistant, IRDT, Kanpur, U.P.
From N	ITTTR, Chandigarh
7.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, Coordinator

NEED ANALYSIS

Learning in general goes on with life informally but in Education systems there are always some patterns to partake knowledge to desirous ones in definite period and systematic manners, developing their knowledge and skill both. The world of knowledge is evergrowing and there always remains something to aid to make the students update, so it is inperative to make relevant changes in the curriculum in the form and content both. Chemical Engg. Diploma curriculum in the state was a four year course since long and it was felt that it should be consolidated to fit in the frame of three year span without damaging its meaningful features and including all that is important in the present scenario of Industries today. Reducing the time span was due to make it uniform like many other diploma courses running in the state polytechnics, also it is to releive the parents from the burdens of expensive training of their wards not only this, the feed back from the Institution too suggested this, with all these considerations in the view, a number of formal and informal workshops were held in this Institute itself and other institution also for this purpose and upshots of these workshops have been properly arranged to systematise classroom teaching.

The important features of the presently proposed $% \left({{{\mathbf{r}}_{\mathbf{r}}}_{\mathbf{r}}} \right)$ are as given below –

- 1. It has been made more skillful oriented, emphasizing more practical auspects the list of practicals have been thoroughly revised and enriched with additional important practicals, like other courses here too. Industrial training has been given due weightage.
- In Second year level, the paper Fuel & Matrial Technology has been renamed as " Conventional and Non Conventional Source of Energy ".

With all these changes, it is hoped that the new proposed course will prove conducive to students for employment point of view.

V- PROFILE DEVELOPMENT

A tool in form of a questionnaire was designed and sent to various organisations, industries, higher technological institutes and polytechnics for getting informations about job opportuntities, man power requirements and job activities of diploma holders in chemical engineering.

Feed back was taken from experts through questionnaire, personal interviews and workshops was analysed and a draft structure of curriculum was prepared in the workshop held at I.R.D.T., U.P., Kanpur adopting the following procedure.

1. Listing job potential and job activities.

2. Analysing activities into knowledge and skill.

- 3. Deriving the course objectives.
- 4. Deriving subject areas from course objectives.
- Planning horizontal and vertical organisation of subjects.
- 6. Developing study and evaluation scheme.
- Developing detailed course contents and coverage time keeping in view the knowledge and skill requirement.
- 8. Determining resource input in terms of human and information resources, space & equipments etc.

VI-JOB POTENTIAL/JOB OPPORTUNITIES :

(A) The diploma pass outs can seek the job opportunities in following type of organisations

S.NO	DEPARTMENT/ORGANISATION	POSITION/DESIGNATION
1.	O.N.G.C.	Supervisor
2.	Oil Refineries	Supervisor
3.	Pharmacentical	Technician
4.	Fertilizer Factories	Shift Engineer
5.	Process Industries	Foreman
6.	Chemical Industries	Senior Operator
7.	Petro Chemical Industries	Foreman
8.	GAIL India Limited	Jr. Engg./Operator
9.	Indian Oil Corporation	Production - Jr. Engg./Operate
10.	Research Organisationsing	Technician
	Chemical Engineering	
(B)	Names of specific industries wher were empolyed.	re diploma pass outs
11.	Bharat Petroleum Corporation Ltd.	Jr. Engg./Operator
12.	Indian Glysol Ltd, Kashipur	Trainee Operator
		Shift Engineer
13.	Pashupati Acrilon Ltd., Kashipur	Do
14.	Prakash Pipe Tubes, Kashipur	Chemist In Lab
orat-		
		ory.
15.	Dynora T. V., Kashipur	Chemist
16.	Flow More Ltd., Kashipur	Operator
17.	Nepa, Pulp Paper Industry, Aliganj,Kashipur	Chemist/Operator
18.	Paper Industry, Lalkuawan(Pantnaga	ar) Chemist/Operator
19.	Heavy Electrical Ltd., Haridwar	Chemist
20.	IFFCO, Aonla, Bareilly	Tranee Operator
21.	Bhaba Atomic Research Centre	Shift Chemist/
	Bombay	Supervisor
22.	Bhaba Atomic Research Centre	Shift Chemist/
	Kota, Rajasthan	Supervisor
23.	Indo Gulf Fertilizer Ltd.	Supervisor/Shift
	Jagdishpur	Engineer
24.	Hindustan Salt Ltd., Ram Nagar	Supervisor
25.	J. K. Synthetic, Kota	Supervisor
26.	Cement Corporation of India	Supervisor
27.	Hindustan Insecticides Ltd Delbi.	Supervisor
28.	Sri Ram Fertilizer & Chemicals New Delhi.	Supervisor
29.	Easter India Ltd., Khatima (Nainital)	Supervisor
30.	Sumaia Chemicals, Barabanki	Supervisor
31.	Mohan Mekien Distilleries Ltd., Ghaziabad	Operator
32.	Steel Authority of India Ltd.	Supervisor
33.	Bharat Electronics, Ghaziabad	Supervisor
34.	Vam Organic Gajrola Moradabad	Supervisor
25	Atomia Deven Drojact Nanauna	Operator

S.NO	DEPARTMENT/ORGANISATION	POSITION/I	DESIGNATION
36.	Synthetics & Chemical, Bareilly	Supervisor	r
37	U P Straw & Agro Products	Supervisor	-
01.	Agyannur (Moradahad)	Dupervises	-
30	Comptor (Allied Broducts	Suportico	<u>^</u>
50.	Paroilly	Supervisoi	L
20	Balellly Khaitan Fortilizon Dampur	Cuporrigo	~
39. 40	Rhaitan Fertilizer, Rampur	Superviso	
40.	Rampur Distillaries & Chemicals	Chemical A	Analyst
	Rampur.		
41.	Modi Zerox, Rampur	Superviso	<u>c</u>
42.	Modi Olivetti (Computer), Rampur	Superviso	c
43.	Modi Rubber & Chemical Industries	Superviso	r
	Modi Nagar.		
44.	Modi Pon, Modi Nagar	Superviso	r
45.	Modi distilleries, Modi Nagar	Superviso	r
46.	Bajpur Distillery. Bajpur	Superviso	<u>c</u>
47.	Dauralla Distillery & Chemicals	Superviso	or
	Dauralla, Meerut		
48.	U. P. Tiwiga Fibre Glass Ltd.	Supervisor	r
	Secundrabad (Ghaziabad)		
49.	Dewan Rubber Industries, Meerut	Superviso	r
50.	Dewan Tyres Ltd., Meerut	Supervisor	r
51.	Kanoria Chemicals Ltd., Mirzapur	Supervisor	c .
52.	Indian Petrochemicals & Complex	Operator	
	Ltd., Baroda	-	
53.	Mathura Refinery, Mathura	Operator	
54.	National Organics & Chemicals	Operator	
	Ltd., Bombay	-1	
55.	Indian Drugs & Pharmaceuticals	Operator	
	Ltd . Rishikesh	-1	
56.	Ramganga Fertilizer Ltd. Gairola	Superviso	r
00.	(Moradabad)	5 dp 01 (100)	-
57	Shree Chemicals & Industries Ltd .	Superviso	r
0,.	Gairola (Moradabad)	Supervised	_
58	Steel Authroithy India Itd Delhi	Superviso	<u>^</u>
50. 59	Dunkan Industries Itd Panki Kannu:	r	Supervisor/Operator
5 5. 60	Johia Group	L	Supervisor/Operator
00.	A- Injectonlast Itd Panki		Supervisor/Operator
	R- Startinger Itd Panki		Supervisor/Operator
	C- Machinery Manufacture Itd. Ch	hanir	Supervisor/Operator
	C- Machinery Manufacture Ltd. Cha	aupepur	Supervisor/Operator
61	Rampur Denat.		Cuponui con (Openator
62	Coodlaga Marolag Dointa Itd. Joinny	IN UDGIDG	Supervisor/Operator
02.	Goodiass Merolac Paints Ltd., Jainpo	ur, opside,	Supervisor/Operator
60	industrial Area, Kanpur Denat.	-	
63.	M.L.A. Group of Industries, Harsh I	Nagar,	Supervisor/Operator
<u> </u>	Kanpur		
64.	Scooter India Ltd. Paints Shop, Sa:	rojini	Supervisor/Operator
65	Nagar Lucknow.		
65.	L.M.L., Ltd., Paints shop, Panki.		Supervisor/Operator
66.	India Polyfibre Ltd., Barabanki		Supervisor/Operator
67.	Somaiya Organics Ltd., Barabanki.		Supervisor/Operator
68.	Superhouse Leather Ltd.Unnao.		Supervisor/Operator
69.	Raymonds Synthetics Ltd.,Karchhena,	,Allahabad	Supervisor/Operator
70.	Oswal Fertilizers & Chemicals Ltd,	Super	rvisor/Operator
	Fertilizer Div., Babrala, Shahjahanpur		
71.	Tata Chemicals Ltd., Badayun	Super	rvisor/Operator
72.	U.P. Asbertos Ltd. Lucknow	Super	rvisor/Operator

73.	Hindustan Lever Ltd., Orai	Supervisor/Operator
74.	Hindustan Lever Ltd., Hamirpur	Supervisor/Operator
75.	Vegipro Ltd., Orai	Supervisor/Operator
76.	Larsan & Toubro, Bombay	Supervisor/Operator
77.	KTI, Ltd., Delhi	Supervisor/Operator
78.	Mc Dowell Industries, Ltd, Banglore	Supervisor/Operator
79.	IPCL, Baroda	Supervisor/Operator
80.	Panjab Tractor, Bhewani	Supervisor/Operator
81.	Hindalco Ltd., Renukut, Mirzapur	Supervisor/Operator
82.	Hindustan Lever Ltd., Banglore	Supervisor/Operator
	(Research Division)	
83.	Indian oil Corporation Ltd.	Supervisor/Operator
84.	GAIL India Limited	Supervisor/Operator
85.	Reliance Industries Ltd., Bombay	Supervisor/Operator
86.	Reliance Petrochemical Ltd.(Refinery)	Supervisor/Operator
	Jamnagar	
87.	MRPL, Mangalore	Supervisor/Operator
88.	ESSAR Refinery Ltd. Jamnagar	Supervisor/Operator
89.	Chambal Fertilizers Ltd., Kola Rajasthan	Supervisor/Operator
90.	Nagarjuna Fretilizers, Andhra Pradesh	Supervisor/Operator
91.	R.C.F.(Rashtriya Chemical & Fertilizers	Supervisor/Operator
	Bombay)	
92.	Insilco , Gujralla, Moradabad	Supervisor/Operator
93.	Malvika Steel Industries, Jagdishpur,	Supervisor/Operator
	Sultanpur	
94.	K.M. Sugar Mills & Distillary Div., Masoudha	Supervisor/Operator
95.	Yash Paper Mills, Faizabad	Supervisor/Operator
96.	H.P.C.L.(Hindustan Petroleum Co. Ltd.)	Supervisor/Operator
	Bombay	
97.	Balrampur Chinee Mill & Distillery Div.	Supervisor/Operator
	Balrampur	
98.	Oil Refinery India, Ltd., Digboi (Assam)	Supervisor/Operator
99.	NALCO, Orissa	Supervisor/Operator
100.	BALCO, Korba (M.P.)	Supervisor/Operator
101.	NALCO Chemicals, Bombay	Supervisor/Operator

(C) SELF EMPOLYMENT:

A diploma pass out in Chemical Engineering can start industries.

- (i) Manufacturing of Paints & Varnishes.
- (ii) Manufacturing of Plastic & rubber Articles.
- (iii) Manufacturing of domestic utility articles such as Soap,
 - Detergent, Edible oils, Hair oils etc.
- (iv) Small scale packing industries.
- VII. JOB ACTVITIES :
 - (A) GENERAL:
 - 1. OPERATION OF CHEMICAL PLANT:
 - 1.1 Supervises the operation of chemical plants.
 - 1.2 Supervise the process control
 - 1.3 Training of crafts man

- 1.4 Manages labour materials and utilities
- 1.5 Safety of workers and equipments
- 2. CHEMICAL ANALYSIS :
 - 2.1 Analysis of sample
 - 2.2 Interpretation of results of analysis
- 3. ERECTION AND COMMISSIONING OF CHEMICAL PLANT :
 - 3.1 Reading and inter-preting the sketches, drawings
 - 3.2 Preparing inventory control and costing.
- 4. INSPECTION AND TESTING OF CHEMICAL EQUIPMENT :
 - 4.1 Inspection and testing performance of individual equipment.
 - 4.2 Fault finding or trouble shooting and its rectification.
- 5. MARKETING :
 - 5.1 Explaining the salient features and performance of the product and comparison with regard to other such available equipments in the market.
 - 5.2 Preparing estimates and contract documents
 - 5.3 Booking of orders and making relevent documents and correspondence.
 - 5.4 Servicing of equipments and instruments.
 - 5.5 Inventory control and determination of material requirement.
 - 5.6 Preparation of tender documents and investing tenders.
 - 5.7 Placing orders and receiving the supplies.
- 6. PROJECT PREPARATION AND EVALUATION :
 - 6.1 To scrutinise the project reports for Chemical plants from the point of view of feasibility and finances involved.
- 7. TEACHING, RESEARCH AND TRAINING :
 - 7.1 To assist the teachers in imparting instructions to students.
 - 7.2 To set up laboratory equipments for

experimental work.

- 7.3 Preparation of specifications of various equipments and instruments.
- 7.4 Preparing of tender.
- 7.5 Receipt of supplies and their inspection and testing according to specifications.
- 7.6 Maintains the equipments and instruments in the laboratory.

(B) SELF EMPLOYMENT:

- (a) Setting up of small scale chemical industry
- (b) Setting up an ancillary industry for big chemical plants.

ACTVITY ANALYSIS:

S.No.	Activity	Knowledge Required	Skill Required
GENERA	L:		
1.1	Supervisors / T Sr. Operators i and allied indu	Pechnicians / n Chemical astries :	
1.1.1	Supervises the Operation of Chemical Plants.	 Knowledge of : Inorganic and organic chemistry and part of physical chemistry. Unit operations such as fluid flow heat transfer, mass transfer, mechanical operation etc. Unit process of inorganic and organic industries. Process testing instrument their principle of operati working and constructional details. 	Skill in operation of individual chemical equipment and related instrument.
1.1.2	Supervises the process control.	 Knowledge of : Unit process of inorganic and organic chemical industries. Instruments used in process control, their principle of operation, working and constructional details. Various types of break downs their causes and rectification. Effect of break down on the 	Skill in the use of instruments. Skill in attending the break downs.
1.1.3	Training of Crafts man	 working of industry. Knowledge of subject matter of chemical plants i.e. equipments and processes. Collection of feed data and effective communica- tion methods. 	Skill in planning and supervising of training, communi- cation techniques.

S.No.	Activity	Knowledge Required Skill Required	
1.1.4	Manages labour materials and utilities.	- Modern methods of labour Skill in leadersh management,labour welfare Skill in communic activities. tion techniques.	nip, ca-
		- Labour laws and acts, workman compensation act, strikes and lock-outs etc.	
		- Principles of material management.	
		- Departmental purpose, rules and specification of materials.	
		- Inventory control.	
		- Stores management layout, method of storage, and stores maintenance i.e. bincards, leadger etc.	
		- Use of utilities in the plant.	
1.1.5	Safety of workers and equipments.	 Safety rules and other departmental precautions of plants and equipment. Importance of safety in an industry. Skill in conductions safety operations 	n .ng
		- Knowledge of different Skill in operation safety procedures. Safety equipments	ng 3.
		 Different safety equipment Skill in first ai its principle of working, operations. layout and operation. 	.d
1.2 S	UPERVISOR FOR CH	EMICAL ANALYSIS :	
1.2.1	Analysis of sample	- Knowledge of chemical Skill in handling analysis. various instrumen and requirements the lab.	∫ its in
		 Knowledge of qualitative and quantitative analysis. Knowledge of analytical instruments. 	
1.2.2	Interpretation of results of analysis.	 Knowledge to present the Skill in reaching results in a qualitative conclusion. form. Knowledge of basic chemical calculations 	ß at

S.No.	Activity	Knowledge Required	Skill Required
1.3	SUPERVISOR FOR COMMISSIONING OF	ERECTION AND CHEMICAL PLANTS:	
1.3.1	Reading and - interpreting the sketches, drawings	Principle of projections first angle projection & third angle projection.	Skill in reading and interpreting drawing & sketches.
		Descriptions, working and use of various drawing instruments & equipments.	Skill in use of drawing instrument and equipment.
	-	Knowledge of various process and equipment.	Skill in reprography , preparations of detailed manufactur-
	-	Methods of reading and interpreting the drawings and blue prints.	ing drawings.
	-	Preparation of detailed manufacturing drawing from line diagrams.	
1.3.2	Preparing - inventory control and	Inventory control methods	Skill in maintenance of stores and ordering procedures.
	costing	Store-keeping	
	-	Cost estimation	
1.3.3	Preparation - of working schedule.	Realistic time estimates for various jobs.	Skill to handle labour.
1.3.4	Erection and - commissioning	Knowledge of plant and machinery and process.	Skill to handle labour.
	-	Workshop Practice	Skill in workshop practice, skill in demonstration.
	-	Foundation practice	Skill in testing
	-	Handling equipment	equipments.
	-	Transporation of	
	-	equipments used for	
	-	Knowledge of safety	
	-	of equipment Simple design	
		calculations.	

 1.4 Supervisor for equipment testing and inspection : 1.4.1 Inspection \$ - Necessity of inspection at various stages of formance of manufacture, operation and maintenance. equipment Modern methods of conducting inspections Various tests and testing procedures to determine the process-performance of the individual equipment Importance of performance test for equipment and to fix its periodicity. 1.4.2 Fault finding - Knowledge of various process and equipment Importance of performance its rectification Various probable fault monitoring Various probable fault monitoring Various probable fault monitoring Techniques in fault investigation and torouble shooting Techniques in fault investigation and coverhauling of equipment Importance of maintenance in running of a factory Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales supervisors in various chemical units : - Stales representatives / purchase assistants or marketing / sales the product and - Description, principle of Skill in god 	S.No.	Activity	Knowledge Required	Skill Required
 1.4.1 Inspection & testing performance of formance of individual equipment. Modern methods of conducting inspections. Modern methods of conducting inspections. Various tests and testing procedures to determine the process-performance of the individual equipment. Importance of performance test for equipment and to fix its periodicity. 1.4.2 Fault finding or trouble process and equipment. Importance of performance and process monitoring. Various probable fault which are likely to occur in processes and equipment. Techniques in fault shooting. Techniques in fault shooting. Methods of repair and overhauling of equipment. Methods of repair and overhauling. Importance of maintenance in running of a factory. Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufactor is a product & its utilities. market if the product and - Description, principle of Skill in good 	1.4 S t	Supervisor for e sesting and insp	quipment ection :	
 Modern methods of conducting inspections. Wodern methods of conducting inspections. Various tests and testing procedures to determine the process-performance of the individual equipment. Importance of performance test for equipment and to fix its periodicity. 1.4.2 Fault finding - Knowledge of various or trouble shooting and its rectificer various probable fault monitoring. Various probable fault monitoring. Various probable fault monitoring. Techniques in fault shooting. Techniques in fault shooting. Methods of repair and overhauling of equipment. Methods of repair and overhauling of equipment. Importance of maintenance in running of a factory. Preventive maintenance and processes assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufactor mance if the product & its utilities. The product & its utilities. The product and - Description, principle of Skill in good 	1.4.1	Inspection & testing per- formance of individual	 Necessity of inspection at various stages of manufacture, operation and maintenance. 	Skill in inspection techniques.
 Various tests and testing procedures to determine the process-performance of the individual equipment. Importance of performance test for equipment and to fix its periodicity. 1.4.2 Fault finding or trouble shooting and its rectification. Various probable fault monitoring. Various probable fault monitoring. Various probable fault monitoring. Techniques in fault shooting. Techniques in fault shooting. Techniques in fault shooting. Techniques of repair and overhauling of equipment. Methods of repair and overhauling. Importance of maintenance in running of a factory. Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufaction for the product and - Description, principle of Skill in good 		equipment.	- Modern methods of condu- cting inspections.	Skill in testing the equipment.
 Importance of performance test for equipment and to fix its periodicity. 1.4.2 Fault finding or trouble shooting and its rectification. Knowledge of various process and equipment. Ince and process mance and process monitoring. Various probable fault monitoring. Various probable fault monitoring. Techniques in fault shooting. Techniques in fault shooting. Techniques in fault shooting. Techniques in fault shooting. Methods of repair and overhauling of equipment. Methods of repair and overhauling. Importance of maintenance in running of a factory. Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufacs skill in explaining the product & its utilities. the performance of the product and - Description, principle of Skill in good 			- Various tests and testing procedures to determine the process- performance of the individual equipment.	
 1.4.2 Fault finding or trouble shooting and its rectification. Various probable fault which are likely to occur in processes and equipments. Various probable fault which are likely to occur in processes and equipments. Techniques in fault investigation and trouble shooting. Techniques in fault overhauling of equipment. Methods of repair and overhauling. Importance of maintenance in running of a factory. Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufactor skill in explaining the product and - Description, principle of Skill in good			- Importance of performance test for equipment and to fix its periodicity.	
<pre>cation. which are likely to occur in processes and skill in trouble equipments. Skill in repair investigation and trouble and overhauling shooting Techniques in fault Skill in repair investigation and trouble and overhauling of equipment. - Methods of repair and overhauling. - Importance of maintenance in running of a factory. - Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufac- salient featu- turing processes of the res & perfor- mance if the product and - Description, principle of Skill in good</pre>	1.4.2	Fault finding or trouble shooting and its rectifi-	 Knowledge of various process and equipment. Various probable fault 	Skill in conducting preventive mainte- nance and process monitoring
 Techniques in fault investigation and trouble shooting. Methods of repair and overhauling. Importance of maintenance in running of a factory. Preventive maintenance and preparation of its schedule. Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : Explaining the - Knowledge of the manufac- res & perfor- mance if the product and - Description, principle of Skill in good Skill in good 		cation.	which are likely to occur in processes and equipments.	Skill in trouble shooting.
 Methods of repair and overhauling. Importance of maintenance in running of a factory. Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufac- salient featu- res & perfor- mance if the product & its utilities. the product.			- Techniques in fault investigation and trouble shooting.	Skill in repair and overhauling of equipment.
 Importance of maintenance in running of a factory. Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufac- Skill in explaining the performance of the performance of the performance of the product & its utilities. the product. mance if the product and - Description, principle of Skill in good 			- Methods of repair and overhauling.	
 Preventive maintenance and preparation of its schedule. 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufac- Skill in explaining salient feature turing processes of the the performance of the performance of product & its utilities. the product. mance if the product and - Description, principle of Skill in good 			- Importance of maintenance running of a factory.	in
 1.5 Sales representatives / purchase assistants or marketing / sales supervisors in various chemical units : 1.5.1 Explaining the - Knowledge of the manufac- salient featu- turing processes of the res & perfor- product & its utilities. the performance of the product. mance if the product and - Description, principle of Skill in good 			- Preventive maintenance and preparation of its schedul	le.
1.5.1 Explaining the - Knowledge of the manufac- salient featu- res & perfor- mance if the product and - Description, principle of Skill in explaining the manufac- the manufac- skill in explaining the performance of the performance of the product.	1.5 S	ales representa assistants or : supervisors in units :	tives / purchase marketing / sales various chemical	
product and - Description, principle of Skill in good	1.5.1	Explaining the salient featu- res & perfor- mance if the	- Knowledge of the manufac- turing processes of the product & its utilities.	Skill in explaining the performance of the product.
		product and	- Description, principle of	Skill in good

	comparison with regard to other such available equipments in the market.	working and special features of the equipme Modern methods of sales promotion.	Sales-manship. nt. Skill in demonstrating the working of the equipment.
S.No.	Activity	Knowledge Required	Skill Required
		Knowledge of other simi products in the market. Operation of the equipm	lar ent
		and demonstrating the performance.	
1.5.2	Preparing estimates & contract documents.	 Principle of estimation Various methods of estimation. Knowledge of department. 	 Preparation of estimates. Preparation of contract documents.
		<pre>rules and general sale/ purchase conditions suc as earnest money, secur deposits, warranty claim etc. Preparation of estimate and contract documents.</pre>	Skill in setting h warranty claims. ity ms
1.5.3	Booking of orders and making relevant documents and correspondence.	Knowledge of office pro dures initiating a corr pondence, putting the notes, drafting letter and coresspondence.	ce- Skill in making es- official e correspondence. s
		Techniques in procedure of placing orders. Knowledge of market dem and trend. Methods of conducting m survey to determine mar trend.	Skill in office procedure. and arket ket
1.5.4	Servicing of equipment and instruments.	 Importance of service a sales in promotion of p sale. Principle of working of equipment and instrumen manufactured. Various defects and its Explaining the importan preventive and routine maintenance to customer 	tter roduct various ts repair. ce of

S.No.	Activity	Knowledge Required	Skill Required
1.5.5	Inventory - control and determination	Principle of inventory control.	
	of material - requirement.	• Knowledge for consolidating the requirement of material and lead time.	g 1
1.5.6	Preparation of - tender docu - ments and	Detailed specification of materials.	Skill in praparing tender documents.
	investing - tenders.	Preparation of tender documents with various conditions.	
	-	 Inviting tenders according to departmental rules and regulations. 	
1.5.7	Placing orders - and receiving	• Method of making compera- tive statement.	Skill in preparing the supply orders.
	-	Decision making for ordering the material on quality-cum-cost basis.	Skill in inspection of material for accepting and rejection.
	-	Preparing the orders laid down clearly the various conditions of supply.	
	-	Receipt of supplies and inspection of materials according to specification for accepting and rejecting	g.
1.6	Technical assist corporation, bar project reports	ants in financial ks for the secruting for the purpose	
1.6.1	To secrutinise - the project reports for Chemical	Specifications of various raw material used in chemical industry.	Skill in secruti- nising the report.
	plants from - the point of view of feas- ibility and	Knowledge of availability of man power in the area where industry is likely to be so	of e etup.
	finances - involved.	• Various concessions provide by the Govt. such as cheep electricity water, land or concessional rates etc.	ed n

S.No.	Activity	Knowledge Required	Skill Required
		- Knowledge of processes and products its market availability.	
		- To make comparative study analysis of project report for its feasibility.	and
1.7	To work as a teaching / rese and in training large chemical	a technician in earch organisation g organisation of unit :	
1.7.1	To assist the teachers in	- Knowledge of the subjects.	Communication Skill.
	imparting ins	- Teaching methodology.	
	students.	- Students psychology.	
1.7.2	To set up laboratory	- Description and working of the equipment.	Operation of equipment and conduct the
	for experi- mental work.	- Method of setting the equipment.	experiments.
		- Knowledge of the experimen	t.
1.7.3	Preparation of specifications of various equipments and instrumets.	- Principle of specifying the machines, equipments and instruments.	Skill in preparing the specifications.
		- Methods of laying down specifications.	
		- Knowledge of various machi equipments and instruments	nes,
1.7.4	Preparing of tender.	- Specifications of various equipments and materials	Skill in inviting tenders
		 Preparation of tender documents. Knowledge of various sources of availability of chemical equipments and material. Preparation of comparative statement and recommending 	Skill in preparation of tender documents
		the item on quality-cum-co basis.	st

S NO	Activity	Knowledge Required	Skill Required
5.110.			
1.7.5	Receipt of - supplies and their inspec tion &testing according to specification	Receipt of the material.Method of inspection and testing the materials.Conducting inspection and testing of materials according to specification for acceptance and rejecti	Skill in inspection and testing of the equipments and materials.
1.7.6	Maintenance - of equipments and instruments in the labora-	Importance of maintenance in institution and engi- neering industry.	Skill in conducting preventive maintenance.
	tory	Various maintenance methods.	Skill in repairing and overhauling of machines, equipments and instruments.
	-	Importance of preventive maintenance preparation of preventive maintenance, schedule for each machine, equipments & instrument.	
	-	Types of fault, its detect repair and overhauling.	ion
	-	Keeping the maintenance record of each machine equipment and instrument.	
(B) SE	LF EMPLOYEMENT :		
	Self employment of paints, varni	in small scale unit such as shes, chemicals, rubber and	<pre>manufacturing plastic :</pre>
(a)	Setting of - small scale chemical industry.	Methods of conducting market survey for the feasibility of the industry.	Skill in conducting market survey.
	-	Factor affecting site selection.	
	-	Knowledge of various financial sources with their norms and conditions Knowledge of various concessions provided by government to young enterpreunures.	
		22	

- Knowledge of process

S.No.	Activity	Knowledge Required	Skill Required
		- market trends for the sale of product.	
		- Safety and waste treatment	
(b)	Setting up an ancillary industry for	- Market survey to colla- borate with big industry.	Skill in setting up of unit.
	big chemical plants.	- Various financial sources for financing ancillary industry.	
		- Concessions provided by government.	
		- Knowledge of manufacturing processes for the item.	ſ
		 Effective and efficient management of the industry 	· .

VIII- COURSE OBJECTIVE

At the end of course the students should be able to get:

- (A) KNOWLEDGE :
 - (1) Understand the various unit operation and unit processes and their application in different chemical industries like fertilizer, process industry, sugar and plastic etc.
 - (2) Understand various instruments used in process control of chemical industry including use of computer.
 - (3) Understand the organisation and his place in it. Understanding the general procedures of stores, purchase and inventory etc.
 - (4) Understand the techniques of installation, erection and commissioning of equipments/instruments in chemical plants.
 - (5) Understand, interpret and prepare plant layout and flow diagrams.
 - (6) Understand, interpret and prepare project reports.
 - (7) Understand safety goals, waste control and waste treatment (effluent control)
 - (8) Understand the energy conservation and balance.
 - (9) Develop attitude for safety consciousness
- (B) SKILL :
 - (10) Acquire skill in operation, testing and adjustment of chemical equipment/materials used in chemical industry.
 - (11) Acquire the skill in diagnosis of common faults and troubles in process, equipment and instrument and their rectification, repair and overhauling.
 - (12) Acquire skill in reading interpreting and prepare plant layout and flow diagrams.
 - (13) Acquire skill in preparing erection schedule/charts and knowledge of coordination of the organisation using CPM and PERT.
 - (14) Develop skill in operation of chemical plants.
 - (15) Develop skill in use of instruments in chemical industry.

- (17) Develop skill in repair and maintenance of chemical instruments and equipments.

IX- CURRICULUM ANALYSIS FOR IDENTIFICATION OF SUBJECTS

SNo.	Course Objective	Suk	oject(s) of study
(A)	KNOWLEDGE :		
(1)	To understand the various unit operations and unit processes and their application in diff- erent chemical industries like fertilizer, process industry, sugar and plastic etc.	-	Chemical Technology
		-	Unit Operations
		-	Electives
		-	Fluid Mechanics
		-	Mechanical Operation & Solid Handling
		-	Heat transfer
		-	Mass transfer
(2)	To understand various instru-	-	Instrumentation
	of chemical industry including use of computers.	-	Computer Application For Engineering
(3)	To understand the organisation and his place in it. under- standing the general procedure of stores, purchase and inventory etc.	-	Industrial Management & Enterprenurship Development
(4)	To understand the technique	-	Process equipment design
	commissioning of equipments/ instruments in chemical plants.	-	Workshop Practice (Installation and commissioning)
(5)	To understand, interpret and prepare plant layout and flow diagrams.	-	Chemical Technology
(6)	To understand, interpret and prepare project reports.	-	Project work
(7)	To understand safety goals, waste control and waste treatment (effluent control).	-	Pollution Control & Industrial Safety Safety and Chemical hazards.

(8)	To understand the energy	-	Material	Energy	Balance
	conservation and balance.				

(9) To develop attitude for safety - Industrial Safety. consciousness.

SKILL :

- (1) To acquire skill in operation, Workshop Practice. testing and adjustment of chemical equipment / materials used in - Field Exposure chemical industry.
- (2) To acquire the skill in Workshop Practice relating chemical engineering. diagnosis of common faults and troubles in process equipment and instrument and - Field Exposure their rectification, repair and overhauling.
- (3) To acquire the skill in reading, interpreting and prepare plant layout
 Engineering Drawing
 Chemical Tech.
 Process Equipment Design.
 Field Exposure
- (4) To acquire skill in preparing erection schedule/ charts and knowledge of coordination of the organisation using CPM and PERT.
- (5) To develop skill in operation of chemical plants.
- (6) To develop skill in use of instruments in chemical industry.
- (7) To develop skill in communication oral/ written/ through devices.
- (8) To develop skill in repair - Workshop Practice and maintenance of chemical instruments and equipments. - Field Exposure

- Industrial Management
- Process Equipment Design
- Workshop Practice.
- Field Exposure
- Field Exposure
- Chemical Technology
- Workshop
- Measuring Instruments & Measurements
 - Field Exposure
 - Communication Techniques
 - Industrial Management

I Semester

1.1 FOUNDATIONAL COMMUNICATION SECTION "A" (ENGLISH)

L T P 4 – –

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No. Units			Cover	age	. Time	
			L	Т	Р	
Section	A English					
1.	PARTS OF SPEECH	12	-	-		
2.	VOCABULARY BUILDING	05	-	-		
3.	Grammar	15	-	-		
4.	DEVELOPMENT OF EXPRESSION	(Composition)	12	-	_	
Section	B Hindi					
5.	Topic 5	2	-	-		
6.	Topic 6	5	-	-		
7.	Topic 7	5	-	-		
		56 -	-			

DETAILED CONTENTS

1. **PARTS OF SPEECH** :

- a. Noun
- b. The pronoun : Kinds and Usage
- c. The adjective : Kinds and Degree
- d. Determiner : Articles
- e. The verb : Kinds
- f. The Adverb : Kinds, Degree and Usage
- g. Prepositions
- h. Conjunctions
- i. The Interjections
- j. Subject: Verb Agreement (Concord)

2. VOCABULARY BUILDING :

- a. Antonyms and Synonyms
- b. Homophones
- c. One word substitutions
- d. Idioms and Phrases
- e. Abbreviations

3. Grammar

- a. Sentence & its types
- a. Tenses
- b. Punctuations
- c. Active and Passive voice
- d. Transformation of Sentences
- e Synthesis of Sentences
- f. Direct and Indirect Narrations

4. **DEVELOPMENT OF EXPRESSION (Composition) :**

- a. Paragraph Writing
- b. Essay Writing
- c. Proposal Writing
- d. Letter Writing (Formal, Informal, Business, official etc.)
- f. Report Writing
- g. Note Making
- h. News Making
- i. Application Writing
- j. Minute Writing
- k. Invitation Letter Writing

SECTION "B" (Hindi)

- 5— संज्ञा, सर्वनाम, विशेषण, किया विशेषण, वर्ण समास, संधि, अलंकार, रस, उपसर्ग प्रत्यय।
- 6— पत्र लेखन, निविदा संविदा, दर आमंत्रण (कोटेशन) अपील, स्वतन्त्र अभिव्यक्ति, प्रतिवेदन लेखन, प्रेस विज्ञप्ति।
- 7– वाक्य/वाक्यांश के लिए शब्द, पर्यायवाची या समानार्थी शब्द, विलोम शब्द, अनेकार्थी शब्द, शब्दयुग्म या समुच्चारित शब्द समूह, वाक्य शुद्धि (शुद्ध अशुद्ध वाक्य), मुहावरे एवं लोकोक्तियाँ।

1.2 APPLIED MATHEMATICS I(A) [Common to All Engineering Courses]

L T P 3 2/2 -

Rationale:

The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects.

S.N.	Units	Cove	Coverage		
		L	Т	Р	
1.	Algebra- I	8	3		
2.	Algebra- II	8	3	_	
3.	Trignometry	6	2	_	
4.	Differential Calculus-I	10	3	_	
5.	Differential Calculus-II	10	3	-	
		42	14	-	

DETAILED CONTENTS:

- 1. ALGEBRA-I : (10 Marks)
- 1.1 Series : AP and GP; Sum, nth term, Mean
- 1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.
- 1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Crammer's rule
- 2. ALGEBRA-II: (10 Marks)
- 2.1 Vector algebra : Dot and Cross product, Scaler and vector triple product.
- 2.2 Complex number.

Complex numbers, Representation, Modulus and amplitud Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..

- 3. TRIGONOMETRY : (8 Marks)
- 3.1 Relation between sides and angles of a triangle : Statement of various formulae showing relation ship between sides and angle of a triangle.
- 3.2 Inverse circular functions : Simple case only
- 4. DIFFERENTIAL CALCULUS I : (12 Marks)
- 4.1 Functions, limits, continuity, functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.
- 4.2 Methods of finding derivative, Function of a function, Logaritimic differentiation, Differentiation of implicit functions.
- 5. DIFFERENTIAL CALCULUS -II : (10 Marks)
- 5.1 Higher order derivatives, Leibnitz theorem.
- 5.2 Special functions (Exponential, Logarithmic, Inverse circular and function), Definition, Graphs, range and Domain and Derivations of each of these functions.
- 5.3 Application Finding Tangants, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation.

1.3 APPLIED PHYSICS-I

[Common to All Engineering Courses] L T P $_3\ 2/2\ -$

Rationale:

Engineering physics is a foundation Course. Its purpose is to develop proper understanding of physical phenomenon and scientific temper in the students. While teaching the subject, teachers should make maximum use of demonstrations to make the subject interesting to the students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Units & Dimensions	3	1	-
2.	Errors in Measurement	3	1	-
3.	Circular Motion	4	1	-
4.	Motion of Planets	4	1	-
5.	Dynamics of rigid body (Rotational Motion)	5	1	-
6.	Fluid Mechanics and Friction	4	1	-
7.	Friction	4	1	-
8.	Harmonic Motion	5	2	-
9.	Heat & Thermodynamics	6	4	-
10.	Acoustics	4	1	-
		42	14	_

DETAILED CONTENTS:

1. Units and Dimensions (4 Marks)

S.I. Units & Dimensions of physical quantities, Dimensional formula and dimensional equation. Principle of homogenity of dimensions and applications of homogenity principle to:

- i) Checking the correctness of physical equations,
- ii) Deriving relations among various physical quantities,
- iii) Conversion of numerical values of physical quantities from one system of units into another. Limitations of dimensional analysis.
- 2. ERRORS AND MEASUREMENT (4 Marks)

Errors in measuremnts, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement(Combination of erros in addition, substraction, multipication and powers). Significant figures, and order of accuracy in resprect to instruments,

3. Circular Motion (5 Marks)

Central forces. Uniform Circular motion (Horizental and Vertical cases), angular velocity, angular acceleration and centripetal acceleration. Relationship between linear and angular velocity and acceleration. Centripetal and centrifugal forces. Practical applications of centripetal forces. Principle of centrifuge.

4. MOTION OF PLANETS AND SATELLITES : (5 Marks)

Gravitational force, Acceleration due to gravity and its variation w.r. to height and depth from earth, Kapler's Law, Escope and orbital velocity, Time period of satellite, Geostationary, Polar satellites (Concept Only)

5. Dynamics of Rigid Body (Rotational Motion) (6 Marks)

Rigid body, Rotational motion, Moment of inertia, Theorems (Perpendicular and Parallel axis) of moment of inertia (Statement). Expression of M.I. of regular bodies (Lamina, Sphere, Disc, Cylindercal), Concept of Radius of gyration, angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy. Rolling of sphere on the slant plane . Concept of Fly wheel.

6. Fluid Mechanics : (5 Marks)

Surface tension, Capillary action and determination of surface tension from capilary rise method, Equation of continuity (A1V1=A2V2), Bernoulli's theorem, and its application stream line and Turbulent flow, Reynold's number.

7. Friction : (4 Marks)

Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in every day life. Coefficients of static and dynamic friction and their measurements. viscosity, coeff. of viscosity, & its determination by stoke's method.

8. Harmonic Motion (6 Marks)

Periodic Motion , characterstics of simple harmonic motion;

equation of S.H.M. and determination of velocity and acceleration. Graphical representation. Spring-mass system. Simple pendulum. Derivation of its periodic time. Energy conservation in S.H.M.. Concept of phase, phase difference, Definition of free, forced, undamped and damped vibrations, Resonance and its sharpness, Q-factor.

9. Heat & Thermodynamics: (6 Marks)

Modes of heat transfer (Conduction, Convection and Radiation), coefficient of thermal conductivity Isothermal and adiabatic process. Zeroth First, Second Law of Thermodynamics and Carnot cycle, Heat Engine (Concept Only).

10. Acoustics (5 Marks)

Definition of pitch, loudness, quality and intensity of sound waves. Echo, reverberation and reverberation time. Sabine's formula without Derivation. Control of reverberation time (problems on reverberation time). Accoustics of building defects and remedy.

1.4 MECHANICAL OPERATION AND SOLID HANDLING

[Common to Chemical Technology (Fertilizer), Chemical Engineering (Petrochemical)

L	Т	Ρ
4	2	4

Rationale:

Solid handling is the fundamental of different machine and equipments used in the chemical industries such as grinding, crushing, ball mills etc. chain belts and screw conveyor, filteration & mixing equipments. Theoretical and experimental work will indicate their interest in learning and teaching among the students and teachers.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No. Units		Cove	rage	Time
		L	Т	Р
1.	Introduction	6	3	_
2.	Characterisation of Solid	6	3	_
	Particles			
3.	Size Reducation	8	4	_
4.	Conveying of Solid Particles	12	6	_
5.	Mechanical Separation	12	6	_
6.	Mixing Equipments	8	4	_
7.	Fluidization	4	2	-
		56	28	56

DETAILED CONTENTS

1. INTRODUCTION:

Concept and role of unit operation in Industries.

2. CHARACTERISATION OF SOLID PARTICLES:

Characterisation of solid particles, screening equipments, standard screens, screen analysis, Grizzles, trommels.

3. SIZE REDUCTION:

Theory of crushing, Rittinger's law, Kick's law, Bonds Law, Crushing

and grinding machinery; their classification, general description of jaw crusher, gyratory crusher, rol crusher, hammer mills, ball mills, open circuit and closed circuit Systems.
4. CONVEYING OF SOLIDS PARTICLES:

Conveying equipments, their classification general construction and industrial application, Belt conveyors, chain conveyors and screw conveyors.

- 5. MECHANICAL SEPARATIONS:
 - (i) Types of filtration equipement, their application and operation, sand filters, filter press, leaf filters, rotary filters, filter aids. Centrifugal filtration.
 - (ii) Classifiers.

(iii) Thickener

(iv) Cyclones.

6. MIXING EQUIPMENTS:

Details of mixing equipment, Homogenious mixing equipment, Mixing equipments used for liquid-liquid, liquid-solid and liquid-gas system.

7. Fludization

REFERENCE BOOKS

- 1. Unit operation of chemical engineering by Mc Cabe & Smith
- 2. Mechanical Operation for Chemical Engineers by C.M. Narayan and B. C. Bhattacharya
- 3. Chemical Engineering Vol. II by Rechardson & Coulson.
- 4. Momentum Transfer Operation By S. K. Gupta, TMC, 1979

MECHANICAL OPERATION AND SOLID HANDLING LAB

- 1. To draw a layout of Chemical Engineering lab.
- 2. To analyse the given sample on a set of screens and report the analysis.
- 3. To determine the critical speed of a ball mill.
- 4. To determine the efficiency of disintegrator.
- 5. To determine filteration constant by a plate and frame filter press.
- 6. To determine the rate of settling of slurries of various concentration draw a height VS time curve.

- 7. To determine the efficiency of Jaw crusher.
- 8. To study and sketch a Rotary filter.

1.5-MEASURING INSTRUMENTS AND MEASUREMENTS

[Common to Three year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

> L T P 4 2 -

Rationale:

The curriculum of measuring instruments and measurements deals with various measuring instruments like pressure and vacuum gauges, thermometers, pyrometers, orifice, venturimeters, rotameters etc. The students will be well aware of use of these instruments which will inculcate their knowledge.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.N	lo. Units	Cove	rage	Time
		L_	T_	P
1.	Introduction and Classification of Instruments.	12	6	_
2.	Pressure and Vacuum gauges	12	6	_
3.	Thermometers and Pyrometers	12	6	-
4.	Mass & Weight Measurement	10	5	-
5.	Liquid level meters	10	5	-
		56	28	_

DETALLED CONTENTS

1. INTRODUCTION & CLASSIFICATION OF INSTRUMENTS:

Importance of instruments in chemical process industries. General classification of industrial instruments. Indicating and recording type of instruments. Static & Dynamic characteristics of instruments. Description and constructional details, working principle, ranges and application of following instruments.

2. PRESSURE AND VACUUM GAUGES:

Liquid column gauges, Bourdan tube gauge, Melleod gauge, Ionization and thermal conductivity meters.

3. THERMO METERS AND PYROMETERS:

Bimetallic thermometers, liquid expansion thermometers, thermocouples, resistance thermometers, optical and radiation pyrometers.

4. MASS & WEIGHT MEASUREMENT :

Measurement equipment - Two pan balance and single pan mechanical balances, Single pan electronic balance.

5. LIQUID LEVEL METERS:

Visual indicators, Float actuated level meters, static pressure type instruments. The bubbler system, diaphragm box and air trap system. Electrical contact type liquid level indicators. Hydrostatic head density compensator level meter, Hydrostep, Radar or microwave level indicator, Ultrasonic or Sonic level indicator.

REFERENCE BOOKS

- 1. Industrial instrumentation by Donald, P. Ekman
- 2. Instrumentation by Krik and Ramboi.

1.6 WORKSHOP PRACTICE

[Common with Civil Engg., Civil Engg. (sp. in Rural Engg.), Electrical, Ceramic, Dairy, Agriculture, Chemical Technology (Rubber & Plastic), Chemical Technology (fertilizer), Four year chemical Engg.]

[Four year Past time Mechanical Engg. (sp. in Production Engg.)]

- - 14

Rationale

A diploma holder in any branch of engineering has to work in between a skilled workman and an Engineer. In order to have effective control over skilled workmen it is necessary that the supervisory staff must have adequate knowledge and skill. For development of skills workshop practice is very essential.

Units	Cove	rage	Time
	L	Т	Ρ
Carpentry shop			20
Painting & polishing shop	-	-	16
Sheet metal and soldering shop	-	-	56
Fitting shop, Plumbing & Fastening Shop	_	-	24
Foundry shop			20
Smithy shop	_	-	24
Welding shop	-	-	20
Machine shop	-	-	16
		_	196
	Units Carpentry shop Painting & polishing shop Sheet metal and soldering shop Fitting shop, Plumbing & Fastening Shop Foundry shop Smithy shop Welding shop Machine shop	Units Cove: L Carpentry shop - Painting & polishing shop - Sheet metal and soldering shop - Fitting shop, Plumbing & Fastening Shop - Foundry shop - Smithy shop - Welding shop - Machine shop -	Units Coverage L T Carpentry shop Painting & polishing shop Sheet metal and soldering shop Fitting shop, Plumbing & Fastening Shop Foundry shop Welding shop Machine shop

DETAILED CONTENTS

1.		Carpentry Shop :
	EX-1	Introduction & demonstration of tools used in
		carpentry shop and different types of joints, types
		of wood, seasoning and preservation of wood
	EX-2	Planing and sawing practice
	EX-3	Making of lap joint
	EX-4	Making of mortise and tenon joint
	Ex-5	Making of any one utility article such as wooden-
		picture frame, hanger, peg, name plate, etc.

2. Painting and Polishing Shop:

- EX-1 Introduction of paints, varnishes, Reason for surface preparation, Advantange of painting, other method of surface coating i.e. electroplating etc.
- EX-2 To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.
- Ex-3 To prepare metal surface for painting, apply primer and paint the same.
- EX-4 To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

* The sequence of polishing will be as below:

- i) Abrassive cutting by leather wheel.
- ii) Pollishing with hard cotton wheel and with polishing material.
- iii) Buffing with cotton wheel or buff wheel.
- 3. Sheet Metal and Soldering Shop :
 - EX-1 Introduction and Types of sheets, measuring of sheetsEX-2 Study and sketch of various types of stakes/anvil.
 - EX-3 Introduction & demonstration of tools used in Sheet metal working shop.
 - EX-4 Cutting, shearing and bending of sheet.
 - EX-5 To prepare a soap case by the metal sheet.
 - EX-6 To make a funnel with thin sheet and to solder the seam of the same.
 - EX-7 To make a cylinder and to solder the same.
 - EX-8 Preparation of different type of joints such as Lap joint-single seam, double seam. Hemp and wired

joints.

- EX-9 To braze small tube/conduit joints.
- 4.
- Fitting Shop, Plumbing Shop & Fastening Shop:
- EX-1 Study of materials, limits, fits and toterances.
- EX-2 Introduction & demonstration of tools used in Fitting Shop.
- EX-3 Hacksawing and chipping of M.S. flat. Filing and squaring of chipped M.S. job. Filing on square or rectangular M.S. piece.
- EX-4 Making bolt & nut by tap and die set and make its joints
- Ex-5 To drill a hole in M.S. Plate and taping the same to creat threads as per need.
- EX-6 Utility article-to prepare double open mouth spanner for 18" hexagonal head of a bolt.
- EX-7 Cutting and threading practice for using socket, elbow

and tee etc. and to fit it on wooden practice board. EX-8 Study of-bib cock, cistern or stop cock, wheel valve and gate valve etc. EX-9 Practice of bolted joints EX-10 To prepare a rivetted joint EX-11 To make a pipe joint EX-12 To make a threaded joint EX-13 Practice of sleeve joint 5. Foundry Work Ex-1 Study of metal and non metals Ex-2 Study & sketch of the foundry tools. Study & sketch of cupula & pit furnace. Ex-3 To prepare the green moulding sand and to prepare Ex-4 moulds (single piece and double piece pattern sweep mould) Casting of non ferous (lead or aluminium) as per Ex-5 exercise 3. 6. Smithy Shop : EX-1 Study & Sketch of Tools used in smithy shop. EX-2 To prepare square or rectangular piece by the M.S. rod. EX-3 To make a ring with hook for wooden doors. EX-4 Utility article-to preapre a ceiling fan hook. Welding Shop : 7. EX-1 Introduction to welding, classinfication of welding, types of weld joints. EX-2 Welding practice-gas and electric. EX-3 Welding for lap joint after preparing the edge. Welding of Butt joint after preparation of the edge. EX-4 EX-5 'T' joint welding after preparation of edge. Spot welding, by spot welding machine. EX-6 8. Machine Shop EX-1 Study & sketch of lathe machine. Study & sketch of grinders, milling M/c, Drilling M/c EX-1 and CNC Machines Plain and step turning & knurling practice. Ex-2 Study and sketch of planning/Shaping machine and Ex-3 to plane a Ractangle of cast iron.

Semester

2.1 APPLIED MATHEMATICS I (B) [Common to All Engineering Courses]

> L T P 3 2/2 -

Rationale:

The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects.

S.N.	Units	Cove	rage	Time
		L	Т	Ρ
1.	Integral Calculus-I	12	4	
2.	Integral Calculus-II	12	4	-
3.	Coordinate Geometry (2 Dimensional)	10	3	-
4.	Coordinate Geometry (3 Dimensional)	8	3	-
		42	14	

DETAILED CONTENTS:

1. INTEGRAL CALCULUS - I : (14 Marks)

Methods of Indefinite Integration :-1.1 Integration by substitution.

- 1.2 Integration by rational function.
- 1.3 Integration by partial fraction.
- 1.4 Integration by parts.
- 2. INTEGRAL CALCULUS -II : (14 Marks)
- 2.1 Meaning and properties of definite integrals, Evaluation of definite integrals. Integration of special function.
- 2.2 Application : Finding areas bounded by simple curves, Length of simple curves, Volume of solids of revolution, centre of mean of plane areas.

- 2.3 Simposns 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases. 3. CO-ORDINATE GEOMETRY (2 DIMENSION): (14 Marks) 3.1 CIRCLE : Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form. 3.2 Standard form and simple properties Parabola x2=4ay, y2=4ax, Ellipse x2 y2 -- + --=1 a2 b2 Hyperbola x2 y2 --- - ---=1 a2 b2 4. CO-ORDINATE GEOMETRY (3 DIMENSION): (8 Marks) 4.1 Straight lines and planes in space -Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line and Plane (Different Forms),
- 4.2 Sphere $x^2 + y^2 + z^2 + 2gx + 2fy + 2wz=d$ (Radius, Centre and General Equation)

2.2 APPLIED PHYSICS-II

[Common to All Engineering Courses]

L T P 3 2/2 4

Rationale:

Engineering physics is a foundation Course. Its purpose is to develop proper understanding of physical phenomenon and scientific temper in the students. While teaching the subject, teachers should make maximum use of demonstrations to make the subject interesting to the students.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	Т	P
1.	Optics	4	1	_
2.	Introduction To Fiber Optics	4	1	_
3.	Laser & its Application	4	1	_
4.	Electrostatics	4	1	-
5.	D.C. Circuits	4	1	-
6.	Magnetic Materials & Their Properties	4	1	-
7.	Semi Conductor Physics	4	1	-
8.	Introduction Diode & Transistors	4	2	_
9.	Introduction To Digital Electronics	4	2	-
10.	Non-conventional energy sources	6	3	-
		42	14	56

1. Optics (4 Marks)

Nature of light, Laws of Reflection and Refraction, Snell's Law, Interference (Constructive and Deotructive), Diffraction and Polarization (Concept Only), Law of Mallus and Polaroids.

2. Introduction To Fibre Optics : (5 Marks)

Critical angle, Total internal reflection, Principle of fibre optics, Optical fibre, Pulse dispersion in step-index fibres, Graded index fibre, Single mode fibre, Optical sensor.

3. Lasers and its Applications (4 Marks)

Absorbtion and Emission of energy by atom, Spontaneous and Stimulated Emission, Poluation inversion, Main component of

laser and types of laser- Ruby Laser, He-Ne laser and their applications. Introduction to MASER.

4. Electrostatics : (4 Marks)

Coutomb's Law, Electric field, Electric potential, Potential energy, Capacator, Energy of a charged capacitor, Effect of dielectric on capacators.

5. D.C. Circuits (5 Marks)

Ohm's Law, Kirchoff's Law and their simple application, Principle of Wheat Stone bridge and application of this principle in measurement of resistance (Meter bridge and Post Office Box); Carey Foster's bridge, potentiometer.

6. Magnetic Materials and Their Properties: (5 Marks)

Dia, Para and Ferro-magnetism, Ferrites, Magnatic Hysteresis Curve and its utility. Basic idea of super conductivity, Meissner's effect.

7. Semiconductor Physics (4 Marks)

Concept of Energy bands in soldis, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semi conductors, Electrons and holes as charge carriers in semiconductors, P-type and N-type semiconductors.

8. Junction Diode and Transister : (6 Marks)

Majority and Minority charge carriers, P-N junction formation, barrier voltage, Forward and reverse biasing of a junction diode, P-N junction device characteristics, Formation of transistor, transistor-action, Base, emitter and collector currents and their relationship LED's.

9. Introduction To Digital Electronics : (6 Marks)

Concept of binary numbers, Interconversion from binary to decimal and decimal to binary. Concepts of Gates (AND, NOT, OR).

- 10. Non-conventional energy sources: (7 Marks)
 - (a) Wind energy : Introduction, scope and significance, measurement of wind velocty by anemometer, general principle of wind mill.

(b) Solar energy: Solar radiation and potentiality of solar radiation in India, uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector.

PHYSICS LAB

Note: Any 4 experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.

- 2. Determination of 'g' by plotting a graph T2 verses 1 and using the formula g=4n2/Slope of the graph line
- 3. Determine the force connstant of combination f springs incase of 1. Series 2. Parallel.
- 4. To verify the series and parallel combination of Resistances with the help of meter bridge.
- 5. To determine the velocity of sound with the help of resonance tube.
- 6. Determination of viscosity coefficient of a lubricant by Stoke's law.
- 7. Determination of E1/E2 of cells by potentio meter.
- 8. Determination of specific resistance by Carry Foster bridge.
- 9. Determination of resitivity by P.O.Box.
- 10. Verification of Kirchoff's Law.
- 11. To draw Characteristics of p-n Junction diode.
- 12. To measure instantaneous and average wind velocity by indicating cup type anemometer/hand held anemometer.

NOTE :

Students should be asked to plot a graph in experiments (where possible) and graph should be used for calculation of results. Results should be given in significant figures only.

2.3 APPLIED MECHANICS

[Common to three years Diploma Course in Civil Engg., Agriculture, Dairy, Ceramic, Civil & Rural Engg., Chemical Engineering, Architecture Assistantship, Computer Science & Engineering]

[Also Common to Mechanical Engineering (Spacialization In Production Engineering]

[Also common to First year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

L	Т	Ρ
5	1	2

RATIONALE

The subject Applied Mechanics deals with fundamental concepts of mechanics which are useful for the students for further understanding of the second & final year subjects like S.O.M. and theory and design of steel & masonry structures as well as RCC designs. The subject enhances the method ability of the students.

TOPIC WISE DISTRIBUTION OF PERIODS

SL.1	No. Topic	L	T	P
1.	Introduction	4	1	
2.	System of Forces & General Condition of Equilibrium	18	4	
3.	Moment and Couple	8	1	
4.	Friction	8	1	
5.	Machines	8	1	
6.	Center of Gravity	8	2	
7.	Moment of Inertia	8	2	
8.	Beam & Trusses	8	2	
	Total	70	14	28

DETAILED CONTENTS

1. Introduction:

Mechanics and its utility. Concept of scaler and vector quantities. Effect of a force. Tension & compression. Rigid body. Principle of physical independence of force. Principle of transmissibility of a force.

2.A. System of Forces :

Concept of coplaner and non-coplaner forces including parallel forces. Concurrent and non-concurrent forces. Resultant force. Equilibrium of forces. Law of parallelogram of forces. Law of triangle of forces and its converse. Law of polygon of forces. Solution of simple engineering problems by analytical and graphical methods such as simple wall crane, jib crane and other structures. Determination of resultant of any number of forces in one plane acting upon a praticle, conditions of equilibrium of coplaner concurrent force system.

B. General Condition of Equilibrium:

General condition of equilibrium of a rigid body under the action of coplaner forces, statement of force law of equilibrium, moment law of equilibrium, application of above on body.

3. Moment & couple:

Concept of Varignon's theorem. Generalised theorem of moments. Application to simple problems on levers-Bell crank lever, compound lever, steel yard, beams and wheels, lever safety valve, wireless mast, moment of a couple; Properties of a couple; Simple applied problems such as pulley and shaft.

4. Friction:

Types of friction:statical,limiting and dynamical friction, statement of laws of sliding friction, Coefficient of friction, angle of friction; problems on eqilibrium of a body resting on a rough inclined plane, simple problems on friction. Conditions of sliding and toppling.

5. Machines:

Definition of a machine. Mechancial advantage, velocity ratio, input, output, mechanical efficiency and relation between them for ideal and actual machines. Law of a machine Lifting machines such as levers, single pulley, three system of pulleys. Weston differential pulley, simple wheel and axle, differential wheel and axle. Simple screw jack, differential screw jack, simple worm and worm wheel.

6. Centre of Gravity:

Concept, definition of centroid of plain figures and center of gravity of symmetrical solid bodies. Determination of centroid of plain and composite lamina using moment method only, Centroid of bodies with removed portion. Determination of center of 'gravity' of solid bodies - cone, cylinder, hemisphare and sphere, composite bodies and bodies with portion removed.

7. Moment of Inertia:

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical section : rectangle, triangle, circle (without derivations). Second moment of area for L, T, I and channel section, section of modulus.

8. Beams & Trusses:

Definition of statically determinate and indeterminate trusses. Types of supports. Concept of tie & strut, Bow's notation, space diagram, polar diagram, funicular polygon; calculation of reaction at the support of cantilever and simply supported beams and trusses graphically and analytically; graphical solution of simple determinate trusses with reference to force diagram for determining the magnitude and nature of forces in its various members. Analytical methods: method of joints and method of sections.(simple problems only)

Applied Mechanics Lab : Practicals

- 1. To verify the law of Polygon of forces.
- 2. To verify the law of parallelogram and triangle of forces.
- 3. To verify the law of principle of moments.
- 4. To find the coefficient of friction between wood, steel, copper and glass.
- 5. To find the reaction at supports of a simply supported beam carrying point loads only.
- 6. To find the forces in the jib & tie of a jib crane
- 7. To find the forces in the members of a loaded roof truss.

(King / Queen post truss)

- 8. To find the mechanical advantage, velocity ratio and efficiency of any three of the following machines:
 - (i) Simple wheel & axle
 - (ii) Differential wheel & axle
 - (iii) Differential pulley block
 - (iv) Simple Screw jack
 - (v) Simple Worm & worm wheel
 - (vi) System of Pulleys (any type).
- 9. To find out center of gravity of regular lamina.
- 10. To find out center of gravity of irregular lamina.

2.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

L T P 6 - 4

Rationale:

Engineering Chemistry has profound and deep relationship with the industrial and environmental technology. This curriculum intends to impart technical knowledge alongwith productive practice to the students of the diploma engineering. The teachers are expected to guide the students in the classroom and the laboratories according to the curriculum by demonstrations and by showing relevant

⁵²

materials and equipments to inculcate interests in learning among students.

Sl.No	D. Topics	L	Т	P
1.	Atomic Structure	4	_	-
2	Chemical Bonding	6	_	-
3.	Classification of Elements	4	-	-
4.	Electro Chemistry-I	7	_	-
5.	Electro Chemistry-II	8	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	4	-	-
8.	Solid State	4	_	-
9.	Fuels	4	_	-
10.	Water Treatment	6	_	_
11.	Colloidal State	4	_	_
12.	Lubricants	4	_	_
13.	Hydrocarbons	7	_	_
14.	Organic Reactions & Mechanism	8	_	_
15	Polymers	4	_	-
16	Synethetic Materials	6	-	-
		84		 56

TOPIC WISE DISTRIBUTION OF PERIODS

DETAILED CONTENTS:

1. ATOMIC STRUCTURE : (3 MARKS)

Basic concept of atomic structure, Matter wave concept, Quantum number, Haisenberg's Uncertainty Principle, Shaples of orbitals.

2. CHEMICAL BONDING : (4 MARKS)

Covalent bond, Ionic & Co-ordinate, Hydrogen bonding, Valence bond theory, Hybridisation, VSEPR theory, Molecular orbital theory.

3. CLASSIFICATION OF ELEMENTS : (3 MARKS)

Modern classification of elements (s,p,d and f blcok elements), Periodic properties : Ionisation potential electro negativity, Electron affinity.

4. ELECTRO CHEMISTRY-I: (3 MARKS)

Arrhenius Theory of electrolytic dissociation, Transport

number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and bases : Bronsted, Arrhenius and Lewis theory. Concept of pH and numericals. Buffer solutions, Indicators, Solubility product, Common ion effect with their application,

5. ELECTRO CHEMISTRY-II: (3 MARKS)

Redox reactions, Electrode potential(Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change. Standard electrode potential, Electro chemical series and its application. Chemical and Electrochemical theory of corrosion, Galvenic Series. Prevention of corrosion by various method.

6. CHEMICAL KINETICS : (3 MARKS)

Law of mass action, order and molecularity of rection. Activation energy, rate constants, Ist order reactions and 2nd order reactions.

7. CATALYSIS : (2 MARKS)

Definition Characteristics of catalytic reactions, Catalytic promotors and poison , Autocatalysis and Negative catalysis, Theory of catalysis, Application.

8. SOLID STATE : (2 MARKS)

Types of solids (Amorphous and Crystalline), Classification (Molecular, Ionic, Covalent, Metallic), Band theory of solids (Conductors, Semiconductors and Insulators), types of Crystals, FCC, BCC, Crystal imperfection.

9. FUELS : (3 MARKS)

Definition, its classification, high & low Calorific value.Determination of calorific value of solid and liquid fuels by Bomb calorimeter.

Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Disel and Petrol), Benzol and Power alchol. Knocking, Anti-knocking agents, Octane number and Cetane number.

Cracking and its type, Gasoling from hydrogenation of coal (Bergius process and Fischer tropsch's process)

Gaseous Fuel - Coal gas, Oil gas, Water gas, Producer gas, Bio gas, LPG and CNG.

Numerical Problems based on topics

10. WATER TREATMENT : (3 MARKS)

Hardness of water, Its limits and determination of hardness of water by EDTA method. Softening methods (Only Sods lime, Zeolote and Ion exchange resin process). Disadvantage of hard water in different industries, scale and sludge formation, Corrosion, Caustic embritlement, primming and foarming in biolers.

Disinfecting of Water By Chloramine-T, Ozone and Chlorine. Advantage and disadvantage of chlorinational, Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Numerical Problems based on topics.

11. COLLOIDAL STATE OF MATTER : (3 MARKS)

Concept of collidal and its types, Different system of colloids, Dispersed phase and dispersion medium. Methods of preparation of colloidal solutions, Dialysis and electrodialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, Electro phoresis and coagulation. relative stability of hydrophillic and hydrophobie colloids. Protection and protective colloids. Emulsion, Types, preparation, properties and uses. Application of colloids chemistry in different industries.

12. LUBRICANTS : (3 MARKS)

Definition, classification, Necessasity and various kinds of lubricants. Function and mechanism of action of lubricants and examples. Properties of lubricants, Importance of additive compunds in lubricants, Synthetic lubricants and cutting fluids. Industrial application, its function in bearing.

- 13. HYDROCARBONS: (4 MARKS)
- A. Classification and IUPAC nomeuclature of organic compounds hamologous series (Functional Group)
- B. Preparation, properties and uses of Ethane, Ethene, Ethyne (Acetylene), Benzene and Toluene.
- 14. ORGANIC REACTIONS & MECHANISM: (4 MARKS)
- 1. Fundamental auspects -

- A. Electrophiles and nucleophiles, Reaction Intermediates, Free radical, Carbocation, Carbanion
- B. Inductive effect, Mesomeric effect, Electromeric effect.
- 2.A. Mechanism of addition reaction (Markonicove's Rule, Cyanohydrin and Peroxide effect),
- B. Mechanism of Substitution reactions; (Nucleophillic) hydrolysis of alkyle halide, electrophillic substitution halogenation, Sulphonation, Niration and friedel-Craft reaction.
- C. Mechanism of Elimination reaction Dehydration of primary alcohol, Dehyrohalogenation of primary alkyl halide.
- 15. POLYMERS : (3 MARKS)
- 1. Polymers and their classification. Average degree of polymerisation, Average molecular weight, Free radical polymerisation (Mechanisms)
- 2. Thermosetting and Thermoplastic resen -
 - A. Addition polymers and their industrial application-Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.
 - B. Condensation polymer and their industrial application : Nylon 6, Nylon 6,6, Bakelite, Melamine formaldehyde, Urea formaldehyde, Terylene or Decron, Polyurethanes.
- 3. General concept of Bio polymers, Biodegradable polymers and inorganic polymers(Silicon)
- 16. SYNETHETIC MATERIALS : (4 MARKS)
- A. Introduction Fats and Oils
- B. Saponification of fats and oils , Manufacturing of soap.
- C. Synthetic detergents, types of detergents and its manufacturing.
- 3. EXPLOSIVES: TNT, RDX, Dynamite.
- 4. Paint and Varnish

LIST OF PRACTICALS

- 1. To analyse inorganic mixture for two acid and basic radicals from following radicals
- A. Basic Radicals :

NH4+, Pb++, Cu++, Bi+++, Cd++, As+++, Sb+++, Sn++, Al+++, Fe+++, Cr+++, Mn++, Zn++, Co++ Ni++, Ba++, Sr++, Ca++, Mg++

B. Acid Radicals :

CO3--, S--, SO3--, CH3COO-, NO2-,

No3- , Cl-, Br_ , I- , So4--

- 2. To determine the percentage of available Chlorine in the supplied sample of Bleaching powder.
- 3. To determine the total hardness of water sample in terms of CaCo3 by EDTA titration method using Eriochroma black-T indicator.
- 4. To determine the strength of given HCl solution by titration against NaOH solution using Phenolphthalium as indicator.
- 5. To determine the Chloride content in supplied water sample by using Mohr's methods.
- 6. Determination of temporary hard ness of water sample by O-Hener's method.

2.5 ENGINEERING DRAWING

[Common to Three years Diploma Course in Civil Engg., Electrical Engg., Chemical Engg., Dairy, Ceramic, Textile Technology, Textile Chemistry]

[Also Common to Four year Part-time Diploma Course in Electrical Engineering, Mechanical Engineering (Specilization in Production Engineering)]

[Also common to First year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

L	Т	Ρ
4	-	10

Rationale

Drawing, which is known as the language of engineers, is a widely used means of communication among the designers, engineers, technicians, draftmen and craftmen in the industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus, for the effective and efficient communication among all those involved in an industrial system, it becomes necessary that the perosonnel working in different capacities acquire appropriate skills in the use of this graphic language in varying degrees of proficiency in accordance with their job requirements.

Generally speaking, an engineering technician working at the middle level of the threetier technical manpower spectrum, is required to read and interpret the designs and drawings, provided to him by technologists and subsequently to translate them to the craftsmen for actual execution of the job.

This course in Engineering Drawing has been designed, keeping in view, the above refered job functions of a technician in the industry. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects. The contents of the course have been selected as to form a core for the various deversified fields of engineering. It is expected that at the end of this session, the students acqures sufficient skill drafting and some ability in spetial visualization of simple objects.

Sl.	N.	Units	Cove	erag	e Time	
			L	Т	Р	
1.		Drawing Instruents and their use	5		4	
2.	Α.	Lettering techniques	3	—	16	
	В.	Introduction to scales	2	-	8	
3.		Conventional Presentation	5	-	8	
4.	Α.	Principles of projections	3	-	12	
	в.	Point Line, Plane	2	_	28	
5.		Orthographic projection of	5	_	12	

	simple geometrical solids			
6.	Section of Solids	5	-	20
7.	Isometric Projection	5	-	20
8.	Free Hand Sketching	5	-	8
9.	Development of surfaces	5	-	24
10.	Orthographics Projection of			
	Machine Parts	5	-	12
11.	Practice on Auto Cad	6	-	24
		56	_	140

C O N T E N T S

NOT	Е:	Latest Indian Standards Code of Practice to be followed.
1.		Drawing, instruments and their uses. 1 Sheet
1	1.1	Introduction to various drawing, instruments.
	1.2 1.3	Correct use and care of Instruments. Sizes of drawing sheets and their layouts.
2.	(a)	Lettering Techniques 2 Sheet
		Printing of vertical and inclined, normal single stroke capital letters.
		Printing of vertical and inclined normal single stroke numbers.
		Stencils and their use.
	(b)	Introduction to Scales 2 Sheet
		Necesssity and use, R F
		Types of scales used in general engineering drawing. Plane, diagonal and chord scales.
3.	Conven	tional Presentaion : 1 Sheet
	Thread lines, Conven	(Internal and External), Welded joint, Types of Conventional representation of materials, ational representation of machine parts.
4.	(a)	Principles of Projection 1 Sheet

Orthographic, Pictorial and perspective.

Concept of horizontal and vertical planes.

Difference between I and III angle projections.

Dimensconing techniques.

- (b) Projections of points, lines and planes. 1 Sheet
- 5 (a) Orthographic Projections of Simple 2 Sheet

Geometrical Solids

Edge and axis making given angles with the reference planes. Face making given angles with reference planes. Face and its edge making given angles with referance planes.

- (b) Orthographic views of simple composite solids from their isometric views.
- (c) Exercises on missing surfaces and views
- 6. Section of Solids 2 Sheet

Concept of sectioning

Cases involving cutting plane parallel to one of the reference planes and prependicular to the others.

Cases involving cutting plane perpendicular to one of the reference planes and inclind to the others plane, true shape of the section

1 Sheet

7. Isometric Projection. 2 Sheet

Isometric scale

Isometric projection of solids.

8. Free hand sketching

Use of squared paper

Orthographic views of simple solids

Isometric views of simple job like

carpentary joints

9.

Development of Surfaces 2 Sheet

Parallel line and radial line methods of developments.

Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).

10. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet

Nut and Bolt, Locking device, Wall bracket

11. PRACTICE ON AUTO CAD : 2 Sheet

Concept of AutoCAD, Tool bars in AutoCAD, Coordinate System, Snap, Grid and Ortho mode.Drawing Command - Point, Line, Arc, Circle, Ellipse. Editing Commands - Scale, Erase, Copy, Stretch, Lengthen and Explode. Dimensioning and Placing text in drawing area. Sectioning and hatching. Inquiry for different parameters of drawing.

NOTE :

- A. The drawiang should include dimension with tolerence whereever necessary, material list according to I.S. code. 25% of the drawing sheet should be drawn in first angle projection and rest 75% drawing sheet should be in third angle figure
- B. Practice on AutoCAD latest software is to be done in AutoCAD lab of Mechanical Engineering Department of the Institute.

III SEMESTER

3.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L T P 5 2 -

Rationale :

The study of mathematics is an important requirement for the understanding and development of concepts of Engg.The purpose of teaching mathematics to the Diploma Engg. students is to give them basic foundation and understanding of

mathematics so that they can use the same for the understanding of engineering subjects and their advancements.

Sl.No.	Units	Coverage Time			
		L	T	P	
1.	Matrices	16	6	_	
2.	Differential Calculus	15	6	_	
2.	Differential Equations	15	6	_	
4.	Integral Calculus	12	5	_	
5.	Probability & Statistics	12	5	-	
_		70	28	_	

DETAILED CONTENTS

- 1. MATRICES : (12 Marks)
- 1.1 Algebra of Matrices, Inverse :

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix.

Definition and Computation of inverse of a matrix.

1.2 Elementry Row/Column Transformation :

Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence, Rank of a Matrix :

Linear dependence/independence of vectors, Definition and computation of a rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.

1.4 Eigen Pairs, Cayley-Hamilton Theorem :

Definition and evaluation of eign values and eign vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix.

- 2. DIFFERENTIAL CALCULUS : (10 Marks)
- 2.1 Function of two variables, identification of surfaces in space, conicoids
- 2.2 Partial Differentiation :

Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Eulens theorem for homogeneous functions, Jacobians.

2.3 Vector Calculus :

Vector function, Introduction to double and triple integral, differentiation and integration of vector functions, gradient, divergence and curl, differential derivatives.

- 3. DIFFERENTIAL EQUATION : (10 Marks)
- 3.1 Formation, Order, Degree, Types, Solution :

Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of a differential equation, Linear, Nonlinear equation.

3.2 First Order Equations :

Variable seperable, equations reducible to seperable forms, Homogeneous equtions, equtions reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions.

3.3 Higher Order Linear Equation :

Property of solution, Linear differential equation with constant coefficients (PI for X=eax, Sin ax, Cos ax, Xn, eaxV, XV.

3.4 Simple Applications :

LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

- 4. INTEGRAL CALCULUS II: (12 Marks)
- 4.1 Beta and Gamma Functions :

63

Definition, Use, Relation between the two, their use in evaluating integrals.

4.2 Fourier Series :

Fourier series of f(x), -n < x < n, Odd and even function, Half range series.

4.3 Laplace Transform :

Definition, Basic theorem and properties, Unit step and Periodic functions, inverse laplace transform, Solution of ordinary differential equations.

- 5. PROBABILITY AND STATISTICS : (6 Marks)
- 5.1 Probability :

Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution :

Discrete and continuous distribution, Bionimal Distribution, Poisson Distribution, Normal Distribution..

3.2-CHEMICAL ENGINEERING THERMODYNMICS

L T P 6 2 -

Rationale:

The subject incolves the laws of thermodyunamics, refrigeration process, chemical reactions and their equilbrium and chemical kinetics. The student will be well conversent the stratagies involved in the processes.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.1	No. Units	Cover	Coverage T		
		L	Т	Ρ	
1.	Definitions	12	4		
2.	First Law	16	6	-	
3.	. Second Law		6	-	
4.	Entropy		4	_	
5.	. Refrigerations & Liquefaction		4	_	
6.	Vapour Liquid Equilibria	12	4	-	
	Total	84	28	_	

DETAILED CONTENTS

1. INTRODUCTION

Scope of Thermodynamics, open & closed system, Thermodynamic properties-Temperature, Volume, Pressure, Specific heat atconstant volume, Isothermal & Adiabetic process, irreversible & reversible process, Intensive & Extensive properties.

T hermodynamic system, properties and state of a substance, processes and cycle, equality of temp. the Zeroth law of thermodynamics; the pure substance; phases of a pure substance; Phase Rule Independent properties of a pure substance; eqation of state for vapor phase (Wonder Wall Equation).

2. FIRST LAW:

Various froms of energy; Heat work, Internal energy, Enthalpy comparison of heat and work, calculation of U, KE, PE, Q & W first law of thermodynamics for a closed system undergoing a cycle; for a change in state of a closed system; Joule Thomson coefficient J; Throttling process. Calculation of U, H, Q & W for Ideal gas under going

reversible isometric, Isothermal, Isobar and adiabatic processes.

3. SECOND LAW:

Kelvin, Planck and Classius statement, the reversible process, Factors that render process irreversible: the Carnot cycle, Two propositions regarding the efficiency of a Carnot cycle. Thermodynamic temperature scale and ideal gas temperature scale. thermal thermodynamic equation-Maxwell relation.

4. ENTROPY :

Inequality of classius, entropy- a property of a system, Entropy change in reversible process; Entropy change for an open system; principle of increase of entropy; efficiency, irreversibility and availability; simple numerical problem

for calculation of entropy change; thermodynamic relations.

5. REFRIGERATIONS & LIQUEFACTION :

The Cornot refrigeration cycle, the air refrigeration cycle, vapor compression cycle, Absorption refrigeration-flow diagram and their descriptions; coefficient of performance (C.O.P).liqefaction process. Latest refrigerant and their qualities and application.

6. VAPOUR LIQUID EQUALIIBRIA :

Concept of chemical potential, Roult's Law, Henery's Law, Fugacity, Fugacity coefficient activity coefficient.

NOTE:- At least one Question should be asked from each topic (1 To 5).

REFERENCE BOOKS

- 1. Introduction to Chemical Engineering Thermodynamics by J. M. Smith
- 2. Chemical Engineering Thremodynamics by Pandey and Chaudhary
- 3. Chemical Engineering Thermodynamics by Mishra and Rastogi

3.3-MATERIAL ENERGY BALANCE

L T P 6 2 -

Rationale:

The subject deals with the different units such as S. I. units and their conversion, behaviour of ideal gas, Dalton and Amgat's law, humidity and saturation, material balances, crystalization, evaporation, drying, chemical reactions. Different forms of energy like exothermic and endothermic. The students of chemical engineering will enhance their knowledge in this field.

TOPIC WIS	E DISTRIBUTI	ION OF	PERIODS
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Sl.No. Units		Coverage Time		
		L_	T_	P
1.	Scope	5	—	_
2. Dimension, Units		12	4	-
3. Stoichiometric relationship		12	4	_
4. Behavior of Ideal Gases		12	4	_
5.	5. Material balance		4	-
6.	6. Combustion processes			
	(A) Analysis of product	5	2	_
	(B) Problems on fuel analysis	5	2	_
	(C) Problems on fuel gas analysis.	5	2	_
	(D) Oxidation of sulphur	4	2	_
7.	Energy Balance	12	4	-
	Total	84	28	

DETAILED CONTENTS

- 1. Scope of material & energy balance in process industries.
- 2. (a) Dimensions, Units and their conversion factors, S.I units, mole unit, Concept of gm mole, gm atom Use of gravitational conversion factor gc.

Problems relating conversion of one set of units in a function of equation into another equivalent set for mass, length, time, temperature, area, volume, pressure, energy and force of an expression for heat capacity from one set of units to another.

(b) Density & specific gravity, mole fraction (or percent) mass fraction (or percent). conversion of the composition of a mixture from mole fraction (or

percent) to mass(wt.) fraction (or percent) and reverse.

Transform a material from one measure of concentration to another, including mass/volume, moles/volume, PPM, molality, normality and molarity.

3. THE CHEMICAL EQUATION AND STOICHIOMETRIC :

Definition of excess and limiting reactant, conversion, degree of completion and yield in a reaction. Relating problems. Identification of limiting and excess reactant and calculation of percent excess reactant, the percent conversion, Degree of completion of reaction, Yield for a chemical reaction with reactants being in non-Stoichiometric proportion.

4. BEHAVIOUR OF IDEAL GASES :

P V T relationship, standard conditions, partial pressure and pure component volume. Dolton's and Amaget's laws, average molecular weights of a gaseous mixture. Problems relating calculation of composition, average molecular weight, density and molar density, concentration of a gasious mixture.

5. MATERIAL BALANCE :

Tie substance, bye pass streams, recycle and purge, simple problems relating various chemical reactions and without chemical reactions.

- 6. COMBUSTION PROCESS:
 - (a) Analysis of products of combustions :- Proximate and ultimate analysis.
 - (b) Problems of fuel analysis, Air-fuel ratio, Theoretical oxygen/air required.
 - (c) Problems on flue gas analysis .
 - (d) Oxidation of sulphur and its compounds.
- 7. ENERGY BALANCE :

Forms of Energy, Definition of

- (i) Exothermic and endothermic reaction.
- (ii) Standard heat of reaction.

- (iii) Heat of combustion.
- (iv) Heat of formation.
- (v) Heat capacity & mean heat capacity.
- (vi) Net and gross heating value (LHV & HHV).

Calculation of:

- (i) Enthalpy changes (without change of phases).
- (ii) Standard heat of reaction from heat of formation and combustion data.
- (iii) Heat of formation and combustion from combination of heat of reactions at reference temprature.(250 c).
- (iv) Heat of reaction at constant pressure or constant volume.
- (v) Heat of reaction at a temperature different from standard conditions i.e. 250 c (when reactant & products are not at 250 c).

REFERENCE BOOKS

- 1. Stoichiometry by B. L. Bhatt & S. M. Vora
- 2. Chemical Process Principles Part I by O. A. Hougen & K. M. Watson
- 3. Chemical Process Principles Part I by R. A. Rastogi
- 4. Solved Example in Chemical Engineering by G. K. Ray

3.4 ELECTRICAL TECHNOLOGY & ELECTRONICS

(Common with Diploma in Mech., Dairy Engg.)

L T P 5 2 4

Rationale :

The superiority of electricity as power over other means in use in home or industry can not be denied. So it is imperative to introuce the mechanical engineering students with electrical machines and their various uses.

Units	Cove	Coverage Time		
	L	T_	P	
Electric Induction	3	1	-	
A. C. Theory	5	3	-	
Three Phase Circuits	5	3	-	
Measurement & Measuring Instruments	12	4		
Electronics	12	4	-	
D. C. Machines	8	3	-	
Transformers	5	2	-	
Synchronous Machines		2	-	
Induction Motors		2	-	
Electro Heating	6	3	-	
Electro Plating	3	1	-	
	70	28	56	
	Units Electric Induction A. C. Theory Three Phase Circuits Measurement & Measuring Instruments Electronics D. C. Machines Transformers Synchronous Machines Induction Motors Electro Heating Electro Plating	Units Cove L Electric Induction 3 A. C. Theory 5 Three Phase Circuits 5 Measurement & Measuring Instruments 12 Electronics 12 D. C. Machines 8 Transformers 5 Synchronous Machines 5 Induction Motors 6 Electro Heating 6 Electro Plating 3	UnitsCoverage LElectric Induction3A. C. Theory5Three Phase Circuits5Measurement & Measuring Instruments12Electronics12D. C. Machines8Transformers5Synchronous Machines5Electro Heating6Electro Plating313	UnitsCoverage Time LLTPElectric Induction31A. C. Theory53Three Phase Circuits53Measurement & Measuring Instruments124Electronics124D. C. Machines83Transformers52Synchronous Machines52Electro Heating63Electro Plating31702856

TOPIC WISE DISTRIBUTION OF PERIODS

DETAILED CONTENTS

1. ELECTRIC INDUCTION:

Faraday's Laws of electromagnetic induction. Self and mutual induction. Statically and Dynamically induced e.m.f., Lenz's law. Fleming's left hand and right hand rule.

2. A. C. THEORY:

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Production of alternating e.m.f. Definition of cycle, Frequency, Amplitude, Time period, Instantneous, Average,

R.M.S. maximum values of sinosoidal wave. Form factor, peak factor.

Representation of a sinosoidal quantity by a mathematical expression and phasor, phase and phase difference, Relationship of voltage and current for pure resistance, pure inductance and pure capacitive reactance, impedance. Solution and phasor diagrams of simple R.L.C. series and parallel circuits. Active and reactive power. Significance of P.F.

3. THREE PHASE CIRCUITS:

Production of Three phase voltage, advantages of three phase supply. Concept of star and delta connections. Relationship between phase and line values of currents and voltages, Power in three phase circuits, simple numerical problems.

- 4. MEASUREMENT & MEASURING INSTRUMENTS:
 - (i) Primary and secondary instruments-Indicating, Recording and Integrated instruments.
 - (ii) Working principle and construction of the following instruments.
 - (a) Ammeter & Voltmeter (Moving coil & Moving Iron).Extension of their ranges.
 - (b) Dynamometer type wattmeter.
 - (c) Single Phase A. C. Engery Meter.
 - (iii) Measurement of power in a single phase and three phase circuits by wattmeter, Use fo digital multimeter for measurement of voltage, Current and testing of devices.
- 5. ELECTRONICS:

Basic idea of semi conductors P & N type. Semi conductor
diodes, Zener diodes and their applications in rectifiers. Transistors-PNP and NPN-their characteristics and uses at an amplifier (Brief description only). Prniciple characteristics and application of SCR. Devices like UJT, FET, DIAC, TRIAC (Brief introduction, Introduction to operational amplifier, Introduction to basic logic gates and microprocessors.

6. D. C. MACHINES:

D. C. Generator:

Working principle, Constructional details, e.m.f. equation, Types of generators and their applications.

D. C. Motor:

Working principle, Back e.m.f., Types of D. C. motor and elementary idea of their characteristics. Torque equation, Methods of speed control (Description Only).

7. TRANSFORMERS:

Working principle and constructional details of a single phase and 3 phase transformers, e.m.f. equation, Losses and efficiency, Cooling of transformers, Elementry idea of auto transformers and welding transformers.

8. SYNCHRONOUS MACHINES:

(a) Alternators:

Working principle, Types of alternators, Constructional details, E.M.F. equation, Condition for parallel operation.

(b) Synchronous MOtors:

Working principle, Constructional details, Vector diagram, Effect of excitation on armature current and power factor, Synchronous condenser.

- 9. INDUCTION MOTORS:
 - (a) Three Phase Induction Motors:

Working principle and constructional details-Types of induction motors-Slipring and Squirrel cage. Slip in induction motors. Speed torque characteristic, Starting and speed control. Application of induction motors in industry. General faults and their remedies.

- (b) Single Phase Induction Motors: Working principle and constructional details and application of single phase motors (Split phase, Capacitor start and Run Motor). A. C. series motors, General faults and their remedies.
- 10. ELECTRO HEATING:

Types of electro heating. Brief description of resistance ovens and induction furnace and core furnaces.

11. ELECTROPLATING:

Importance of electroplating, Principle of electroplating and equipement used. Processes used in electroplating, Anodising.

ELECTRICAL TECHNOLOGY & ELECTRONICS LAB

- To change the speed and direction of rotation of d.c. shunt motor by
 - (a) Armature control method.
 - (b) Field control method.
- 2. To change the speed and direction of rotation of d.c. compound motor by
 - (a) Armature control method.
 - (b) Field control method.

- 3. To measure the terminal voltage with variation of load current of
 - (a) D.C. shunt generator.
 - (b) D.C. compound generator.
- 4. To perform load test on a single phase transformer and determine its efficiency.
- 5. To start and run a induction motor by
 - (a) Star Delta Starter.
 - (b) Auto Transformer Starter.
- 6. To measure slip of an induction motor by direct loading.
- 7. To start and change the direction of rotation of an induction motor.
- 8. To measure transformation ratio of a single phase transformer.
- 9. To measure power and P.F. in a single phase circuit by Ammeter, Voltmeter and Wattmeter.
- 10. To measure power and P.F. in a 3 phase/A.C. circuit by two wattmeter method.
- 11. To calibrate a single phase energy meter at different P.F.'s and different loads.
- 12. To locate the faults in an electrical machine by a megger.
- 13. To connect a fluorescent tube and note its starting and running current.
- 14. To draw characteristics od Silicon Controled Rectifier (SCR).
- 15. Testing of electrical devices Zenor, Diode, Transistor, FET, UJT, SCR.
- 16. Use of operational amplifier as adder, substractor, comparator, differentiator and integrators.

3.5 INTRODUCTION TO COMPUTER

[Common with Civil Engg., Civil (Spl. With Rural), Mechanical Engg., (Specialisation in Production, Automobile, Refrigeration and Air conditioning), Electronics Engg., Instumentation and Control Engg., Dairy Engg., Leather Technology, Footwear and Leather Goods Tech., Cermics, Chemical Engg. (Four year Sandwitch), Chemical Tech. (Rubber & Plastic), Chemical Tech. (Fertilizer)] L T P

2 - 5

Rationale:

Computers are being used for design and information processing in all branches of engineering. An exposure to fundamentals of computer programming is very essential for all diploma holders. this subject has been included to introduce students in the use and application of computers in engineering.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Cove	rage	Time
		L	Т	Р
1.	Introduction to Computer	4	_	_
2.	Introduction To Operating System (MS DOS/Windows)	3	-	_
3.	Word Processing	4	-	_
4.	Worksheet	4	-	_
5.	Presentation	4	-	-
6.	Data Base Operation	3	-	-
7.	Introduction to Internet	2	_	_
8.	Introduction to advance tools	4	-	-
		28		70

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DETAILED CONTENTS

- 1. Introduction to Computer:
 - A. Block Diagram of Computer.
 - B. Types Of Computer
 - C. Types of Input and Output devices
 - D. Memories Devices (Its Types and Basic).
- 2. INTRODUCTION TO OPERATING SYSTEMS (MS-DOS/MS-WINDOWS:)

What is operating system, its significance, Commands of DOS, Features/Application of window.

- 3. WORD PROCESSING:
 - File : Open, Close, Save, Save as, Search, Send to, Print Preview, Print and Page Setup
 - Edit : Cut, Copy, Paste, Office Clipboard, Select All, Find, replace, Goto, etc.
 - View : Normal/Web Layout/Print Layout; Tool Bars; Header/Footer; Zoom, etc.
 - Insert: Break, Page Number, Date & Time, Symbol, Comment, Reference, etc.
 - Format: Font, Paragraph, Bullets & Numbering, Borders & Shading, Column, Change case, Back ground, etc.
 - Tools : Spelling & Grammer, Language, Word Count, Letters & Mailing, Options, Customize, etc.
 - Table : Draw, Insert, Delete, Select, Auto Format, AutoFit, Convert, Sort, Formula, etc.

Mail Merge

4. WORKSHEET:

Introduction, Use of Tools/Icons for preparing simple Mini Project.

5. PRESENTATION :

Introduction, Use of Tools/Icons for preparing simple presentation on Power Point.

6. DATABASE OPERATION :

Create database using MS Access, Create Table and Creating Reports.

7. Introduction to Internet:

What is Network, How to send & receive messages, Use of Search Engines, Surfing different web sites. Creating Mail ID, Use of Briefcase, Sending./replying emails.

- 8. INTRODUCTION TO ADVANCE TOOLS :
 - I. Steps requires to solving problems.
 - A. Flow Chart
 - B. Algroithm
 - C. Programming

II. Use of advance Tools such as Skype, Teamviewer, Installation of Modem, use of WiFi, Etc.

INTRODUCTION TO COMPUTER LAB

List Of Practicals

- 1. Practice on utility commands in DOS.
- Composing, Correcting, Formatting and Article (Letter/Essay/ Report) on Word Processing tool Word and taking its print out.
- 3. Creating, editing, modifying tables in Database tool.
- 4. Creating labels, report, generation of simple forms in Database tool.
- 5. Creating simple spread sheet, using in built functions in Worksheet tool..
- 6. Creating simple presentation.
- Creating mail ID, Checking mail box, sending/replying emails.
- 8. Surfing web sites, using search engines.

<u>Note</u>: In the final year, related students have to use the concept of MS Word/MS Excel/MS Access/ MS Power Point in their respective branch's project work such as creating project report through MS Word/Creation of statistical data in MS Excel/Creation of database in MS Excel/ Demonstration of project through Power Point Presentation.

4.1 Functional Communication

L T P 4 - -

Sl.No. Units Coverage Time L T P Section A English On Communication 1. 04 **Exploring Space** 2. 04 Sir C.V. Raman 3. 04 Professional Development 04 4. Buying a Second Hand Bicycle 5. 04 Leadership and Supervision 6. 04 7. First Aid 03 _ 8. The Romanance of Reading 03 No Escape from Computers 9. 03 Bureau of Indian Standards 10. 03 Section B Hindi Topic 1 1. 02 Topic 2 02 2. _ _ Topic 3 3. 02 Topic 4 02 4. _ _ Topic 5 02 5. Topic 6 02 6. 7. Topic 7 02 Topic 8 8. 01 _ Topic 9 02 9. _ Topic 10 10. 02 _ Topic 11 11. 01 _ _

TOPIC WISE DISTRIBUTION OF PERIODS

56 -

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Section "A" (English)

Text Lessons

- Unit I. On Communication
- Unit.II Exploring Space
- Unit.III Sir C.V. Raman
- Unit.IV Professional Development of Technicians
- Unit.V Buying a Second Hand Bicycle
- Unit.VI Leadership and Supervision
- Unit.VII First Aid

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Unit.VIII 7	he Romanance	of Reading
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No Escape from Computers Unit.IX

Unit.X Bureau of Indian Standards

Section "B" Hindi

- 1-
- स्वरोजगार भारतीय वैज्ञानिकों एवं तकनीकियों का भारत के विकास में योगदान 2—
- ग्राम्य विकास 3—
- परिवार नियोजन सामाजिक संस्थायें 4—
- 5—
- नियोजन और जन कल्याण 6—
- भारत में प्रौद्यौगिकी के विकास का इतिहास 7—
- हरित कांन्ति 8—
- पर्यावरण एवं मानव प्रदूषण 9—

10-श्रमिक कल्याण

11–भारत में श्रमिक आन्दोलन

4.2 CHEMICAL TECHNOLOGY

L T P 6 2 8

Rationale:

A comprehensive study of the following chemical industries involving process technology, availability of raw materials, production trend, preparation of flow sheet, engineering problems invloving material of construction and uses.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.N	l.No. Units		rage	Time
		L	Т	Ρ
1.	Industrial Gases	8	3	
2.	Fertilizer Industries	8	3	
3.	Chlor-Alkali Industries	8	2	
4.	Sulphur Industries	6	2	
5.	Cement Industries	6	2	
6.	Inseticides, Pesticides and Hertricides	6	2	
7.	Process Industries	-	-	
Α.	Petroleum Refining	6	2	
в.	Suger Industries	6	2	
С.	Fermentation Industries	6	2	
D.	Soap & Detergent Industries	6	2	
Ε.	Pulp & Paper	6	2	
F.	Polymer Industry	12	4	
		84	28	112

DETAILED CONTENTS

1. INDUSTRIAL GASES :

Manufacture and uses of Oxygen, Hydrogen, Nitrogen, Carbon Dioxide.

2. FERTILIZER INDUSTRIES :

Ammonia, Nitric acid, Ammonium Sulphate, Urea, Ammonium Nitrate, Phosphorus, Phosphoric Acid, Calcium Phosphates-Super Phosphates, Triple Super Phosphate, Nitro Phosphate, N-P-K fertilizer.

3. CHLOR-ALKALI INDUSTRIES :

Common Salt, Caustic Soda, Chlorine, Hydrochloric Acid, Soda-Ash, Bleaching Powder.

4. SULPHUR INDUSTRIES :

Manufacture of Sulphuric acid, Oleum.

5. CEMENT INDUSTRIES :

Manufacture of Portland Cement.

6. INSECTISIDES, PESTICIDES & HERBICIDES :

Defnition, types of insectricides, pesticides and hertricides, Uses and Quantity adn variety, beniits.

- 7. PROCESS INDUSTRIES
- A. Petroleum Refining :

Constituent of petrolium including petrolium gases, products of refining, distillation- atmospharic distillation unit and vaccum distillation unit.

B. Suger Industry :

Manufacture of cane suger.

C. FERMENTATION INDUSTRY :

Introduction, Types of fermentation processes, Production of ethyl alcohal by fermentation, Industrial alcohol, manufacture of industrial alcohol-, Beers, Wines & Liquors.

D. SOAP & DETERGENTS INDUSTRY :

Manufacturing of soap, glycerine as by products from soap manufacturing Detergents, Detergents raw material and manufacturing of detergents. House disinfanct (Phynyle).

E. PULP AND PAPER INDUSTRY:

Sulfite & ground wood pulp for paper manufacture of paper, specially paper.

F. POLYMER INDUSTRY :

Types of polymer, Polymerization Process, Manufacture of Polyethylene, Styrene Nylon 6, Nylon 66

REFERENCE BOOKS

- 1. Outline of Chemicals Technology by M. Gopala Rao.
- Chemical Process Industry by Shreve and Austin
 Chemical Technology Vol I & II by G. N. Pandey
- 4. Industrial chemicals by Faith, Keyes and Clark
- 5. Industrial Chemistry by Dr. B. K. Sharma

CHEMICAL TECHNOLOGY LAB.

- 1. Preparation of Phenyl (domestic disinfectant).
- 2. Preparation of Soap.
- 3. Preparation of Detergent/liquid detergent.
- 4. Atmospheric distallation of Petroleum Fractional analysis of petroleum.
- 5. Determination of fife and flash point : Open Cup & Closed Cup
 - A. Cleav land open cup (COC)
 - B. Penskgymartin closed cup (PMC)
- 6. Preparation of Polymer by Bulk Polymerization.
- 7. Preparation of Thermo Plastics PMMA.
- 8. To find out the viscosity and viscosity index of given sample by red wood no-1 and red wood no-2 viscometer.
- 9. To findout viscosity of and viscosity index given sample by Saybolt viscometer.

4.3-CONVENTIONAL AND NON CONVENTIONAL SOURCE OF ENERGY

L T P 5 2 -

Rationale:

The student of chemical engineering has to deal with various types of fuels and materials. The fuels generally used are solid liquid and gaseous. Their properties advantages and disadvantages are included in the curriculum. The student will enhance their knowledge in the field of fuel technologies related to chemical industries.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.N	Io. Units	Cove	rage	Time
		L	T_	P
PART	-A : CONVENTIONAL ENERGY SOURCE			
1.	Introduction	4	2	_
2.	Solid Fuels	10	3	_
3.	Liquid Fuels	10	3	_
4.	Gaseous Fuels	8	2	-
5.	Combustion Calculation	8	2	-
PART	-B : NON CONVENTIONAL ENERGY SOURCE			
1.	Solar Energy	5	2	-
2.	Wind Energy	5	2	-
3.	Bio Energy	5	3	-
4.	Hydro Energy	5	3	-
5.	Geothremal Energy	5	3	-
6.	Wave and Tidal Energy	5	3	-
	Total	70	28	

DETAILED CONTENTS

PART-A : CONVENTIONAL ENERGY SOURCE

1. INTRODUCTION

Introduction of various Solid, Liquid and Gaseous fuels.

2. SOLID FUELS:

Wood, Charcol, Coal (Peat, Lignite, Bituminous and

Anthracite) and Coke . Calorific value Definition and experimental determenation by bomb callorimeter and calculations. Washing of coal, Purpose of washing, Principle description and operation of Jigs and washers, Carbonization (Low temperature and High temperature).

- 3. LIQUID FUELS:
 - (i) Fuel Oil, Gasoline, Desel Fules, Kerosine, Biogas, Biomass, GNG, PNG.
 - (ii) Properties (Sp. gravity, Viscosity, Flash & fire Point, Octane no, Cetane no. & Ignition delay).

(iii Advantages and disadvantages of liquid fuels.

4. GASEOUS FUELS:

Natural Gas, LPG -Advantages and disavantages of gaseous fuels.

5. COMBUSTION CALCULATION:

Calculation of percentage of products of combustion, numerical Quostions.

PART-B : NON CONVENTIONAL ENERGY SOURCE

1. SOLAR ENERGY:

Energy from the Sun, Application of solar technology : Solar thermal, Electricity production, Fuel production, Energy storage methods.

2. WIND ENERGY :

Source of wind energy, Wind power : Types of wind power, Wind power industry : Wind forms, wind turbine.

3. BIO ENERGY:

Resource of Bio energy, Solid biobass, Electricity generation from biomass, Bio energy product.

4. HYDRO ENERGY:

Types of Hydropower, Advantage and disadvantages of hydroenergy

5. GEOTHERMAL ENERGY:

Types of Geothermal energy, Resources, Production, Renewability and sutainability.

6. WAVE AND TIDAL ENERGY:

Generation of Tidal energy and wave energy. Generating methods, Difference between wave and tidal energy. REFERENCE BOOKS

- 1. Nonconventional Energy Resources by D. S. Chauhan
- 2. Thermal Engineering by R. K. Rajpoot
- 3. Fundamental of Renewable Energy System by D. Muknergy

4.4-FLUID MECHANICS

L T P 4 2 4

Rationale:

The subject will enhance the knowledge of students about fluids and their properties like shear, laminar, turbulent, continuity equation, friction losses and other properties of incompressible fluids. Time of emptying a tank, transportation of fluids and measurement of flowing liquids. Theoretical and experimental work will inculcate their interest in learning and teaching among the students and teachers.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.	No. Units	Cove	rage	Time
		L	Т	Ρ
1.	Fluids	6	4	
2.	Flow of incompressible fluids	10	5	-
3.	Measurement of flowing fluids	10	5	-
4.	Pipe and Pipe Fittings	10	5	-
5.	Transportation of fluids	10	5	-
6.	Flow meters	10	4	_
	Total	56	28	56

DETAILED CONTENTS

PART - A

1. FLUIDS

- (i) Properties
- (ii) Classification of Fluids.

(iii)Fluid manometers, description and simple numerical problems.

- 2. FLOW OF INCOMPRESSIBLE FLUIDS:
 - (i) Shear stress distribution in a cylindrical tube, velocity distribution for Newtonion fluid.
 - (ii) Reynold No.Elementry knowledge of laminar and turbulent flow, Reynold experiment.
 - (iii) Continuity equations, Bernaulli's theorem, fluid heads and power requirement calculation.

- (iv) Friction factor, Fanning equation and Hagen Poiseuille equation friction losses in pipes, calculation of friction loss due to enlargement, contraction, fittings and valves.
- (v) N.P.S.H., cavitation, pipes, tubing, fittings & (Valves numerical problems)
- 3. MEASUREMENT OF FLOWING FLUIDS:

Orifice meter, venturimeter, pitot tube, rotameter, weirs and notches (Their construction and derivation of formulae simple mumerical problems, Definition:-Cofficient of contraction, Coefficient of velocity, coefficient of discharge (Simple numerical problems).

4. PIPE AND PIPE FITTINGS :

Tupes. Pipes, Schedule Number, Difference between tube and pipes, Various type of valves (Gate, Close, Check, Pressure Reducing valve, Steam Traps, etc). Pipe fittings (Flange, Socket, Albow, Tees, Star, etc.).Dampener, Stainer

- 5. TRANSPORTATION OF FLUIDS:
 - A. Classification of pumps, construction and operation of Air lift, reciprocating, rotary, centrifugal and gear pumps.
 - B. NPHS, Cavitation, Simples numerical problems.
- 6. FLOW METERS:

Orifice, venturi and nozzle type flow meters, pitot tube, rotameters positive displacement type flow meters.

REFERENCE BOOKS

- 1. Unit operation of chemical engineering by Mc Cabe and Smith
- 2. Chemical Engineering Vol I & II by Coulson & Richardson.
- 3. Hydraulics, Hydraulic Machine and Fluid Mechanics by R. S. Khurmi.

FLUID MECHANICS LAB

- 1. To determine the co-efficient of discharge of orifice-meter by Flow measurement
- 2. To determine the co-efficient of discharge of venturimeter.
- 3. To determine the co-efficient of discharge of V-Notches.
- 4. To determine the co-efficient of discharge of Rectangular Notches.
- 5. To determine coefficient of velocity (Cv), coefficient of discharge (Cd), coefficient of contraction (Cc) and verify the relation between them.
- 6. To determine friction losses in pipes and fittings.
- 7. To verify loss of head due to
 - (a) Sudden Enlargement.
 - (b) Sudden Contraction.
- 8. To verify Bernoullie's Theorem .
- 9. To perform Reynold's experiments.
- 10. To determine the efficiency of a centrifugal pump.
- 11. Study the following.
 - (a) Reciprocating Pump.
 - (b) Pressure Gauge/Water Meter/Mechanical Flow Meter/Pitot Tube.
 - (c) Valves (Gate, Gloves, Cock, Check, Butterfly, Steam trap, Safety valve, Ball valve.

L T P 4 2 -

Rationale:

Air, water and steam are principal plant utilities in any chemical process. Detailed knowledge concerning these utilities will enable the superviser on chemical shop floor to run the various process equipment efficiently.

TOPIC WISE DISTRIBUT:	ION OF	PERIODS
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Sl.	No. Units	Cove	rage	Time
		L	Т	P
1.	Generation, Process & Steam Properties	6	3	
2.	Types of fuels used in boilers	2	1	
3.	Steam Generator.	6	3	
4.	Steam Distribution	6	3	
5.	Pressure & Vaccum system	6	3	
6.	Water	6	3	
7.	Water Treatment Technique	8	4	
8.	Demmiralization	8	4	
9.	Cooling Water	8	4	
	Total	56	28	

DETAILED CONTENTS

1. GENERATION, PROCESS & STEAM PROPERTIES :

Generations of steam at constant pressure, phases of transformation. Pressure-temperature, curve for steam. Latent Heat-external work of evaporation, Sensible heat of water,dry & saturated steam. Dryness fraction,Latent heat of wet steam, detail of wet steam, total heat of super-heated steam, specific volume of wet & super-heated steam. Simple problems using steam-table,

2. TYPES OF FULES USED IN BOILERS :

Types of fuels used in boilers, Coal,Fuel Oil, Rice husk,

Natural gas, etc. produced/forced draught concept.

3. STEAM GENERATOR:

Types of process furnaces and its classification, Method of firing, Types of Burners, Type of steam generators (boilers)-Fire tube & water tube and their principles. Elementry concept and principles of modern water tube boilers. Boiler mountings and accessories. Quantity of heat spent in generation. Ideal cycle of a steam plant. Ways of increasing the efficiency to steam power plant, Trouble shooting of problems (No numerical question).

4. STEAM DISTRIBUTION:

Pipe quality, lay out of piping, steam trap, pressure reducing station : Steam ejectors.

5. PRESSURE & VACCUM SYSTEM:

COnstruction and working of Blowers, Fan, Compressures, Vaccum Pump, Steam Ejectors.

6. WATER :

Different water resources, storage, quality parameters like hardness, suspended solids, turbidity, etc.

7. WATER TREATMENT TECHNIQUES

Water treatments techniques, Flow diagram, Coagulation by Iron compounds like Alum, sedimentation, filteration, Softened by Sodium Carbonate and Bi-carbonate.

8. DEMINERALIZATION :

Demmiralization flow diagram, Cation and Anion exchangers milded bed, Regeneration of cation and anion exchangers and degasor.

9. COOLING WATER :

Recycling of water, Cooling towers, Principals, details and problems like sealing use of inhibitors, like sodium and chromates.

REFERENCE BOOKS

- 1. Engineering Chemistry by P. C. Jain
- Unit Operation of Chemical Engg. by Macabe and Smith
 Thermal Environmental Engineering by J . K. Thiked

4.6 ENERGY CONSERVATION

L T P 3 - 2

RATIONALE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

DETAILED CONTENTS

1. Basics of Energy

- 1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
- 1.2 Global fuel reserve
- 1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
- 1.4 Impact of energy usage on climate

2. Energy Conservation and EC Act 2001

- 2.1 Introduction to energy management, energy conservation, energy efficiency and its need
- 2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
- 2.3 Standards and Labeling
 - 2.3.1 Concept of star rating and its importance
 - 2.3.2 Types of product available for star rating

3. Electrical Supply System and Motors

- 3.1 Types of electrical supply system
- 3.2 Single line diagram
- 3.3 Losses in electrical power distribution system
- 3.4 Understanding Electricity Bill
 - 3.4.1 Transformers Tariff structure
 - 3.4.2 Components of power (kW, kVA and kVAR) and power factor, improvement of power factor
 - 3.4.3 Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
- 3.5 Transformers
 - 3.5.1 Introduction
 - 3.5.2 Losses in transformer

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- 3.5.3 Transformer Loading
- 3.5.4 Tips for energy savings in transformers
- 3.6 Electric Motors
 - 3.6.1 Types of motors
 - 3.6.2 Losses in induction motors
 - 3.6.3 Features and characteristics of energy efficient motors
 - 3.6.4 Estimation of motor loading
 - 3.6.5 Variation in efficiency and power factor with loading
 - 3.6.6 Tips for energy savings in motors

4. Energy Efficiency in Electrical Utilities

- 4.1 Pumps
 - 4.1.1 Introduction to pump and its applications
 - 4.1.2 Efficient pumping system operation
 - 4.1.3 Energy efficiency in agriculture pumps
 - 4.1.4 Tips for energy saving in pumps
- 4.2 Compressed Air System
 - 4.2.1 Types of air compressor and its applications
 - 4.2.2 Leakage test
 - 4.2.3 Energy saving opportunities in compressors.
- 4.3 Energy Conservation in HVAC and Refrigeration System
 - 4.3.1 Introduction
 - 4.3.2 Concept of Energy Efficiency Ratio (EER)
 - 4.3.3 Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5 Lighting and DG Systems

- 5.1 Lighting Systems
 - 5.1.1 Basic definitions- Lux, lumen and efficacy
 - 5.1.2 Types of different lamps and their features
 - 5.1.3 Energy efficient practices in lighting
- 5.2 DG Systems
 - 5.2.1 Introduction
 - 5.2.2 Energy efficiency opportunities in DG systems
 - 5.2.3 Loading estimation

6 Energy Efficiency in Thermal Utilities

- 6.1 Thermal Basics
 - 6.1.1 Types of fuels
 - 6.1.2 Thermal energy
 - 6.1.3 Energy content in fuels
 - 6.1.4 Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)

6.2 Energy Conservation in boilers and furnaces

- 6.2.1 Introduction and types of boilers
- 6.2.2 Energy performance assessment of boilers
- 6.2.3 Concept of stoichiometric air and excess air for combustion
- 6.2.4 Energy conservation in boilers and furnaces

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- 6.2.5 Do's and Don'ts for efficient use of boilers and furnaces
- 6.3 Cooling Towers
 - 6.3.1 Basic concept of cooling towers
 - 6.3.2 Tips for energy savings in cooling towers
- 6.4 Efficient Steam Utilization

7 Energy Conservation Building Code (ECBC)

- 7.1 ECBC and its salient features
- 7.2 Tips for energy savings in buildings
 - 7.2.1 New Buildings
 - 7.2.2 Existing Buildings

8 Waste Heat Recovery and Co-Generation

- 8.1 Concept, classification and benefits of waste heat recovery
- 8.2 Concept and types of co-generation system

9 General Energy Saving Tips

Energy saving tips in:

- 9.1 Lighting
- 9.2 Room Air Conditioner
- 9.3 Refrigerator
- 9.4 Water Heater
- 9.5 Computer
- 9.6 Fan, Heater, Blower and Washing Machine
- 9.7 Colour Television
- 9.8 Water Pump
- 9.9 Cooking
- 9.10 Transport

10 Energy Audit

- 10.1 Types and methodology
- 10.2 Energy audit instruments
- 10.3 Energy auditing reporting format

PRACTICAL EXERCISES

- 1. To conduct load survey and power consumption calculations of small building.
- 2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
- 3. To measure energy efficiency ratio (EER) of an air conditioner.
- 4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
- 5. To measure and calculate energy saving by arresting air leakages in compressor.
- 6. To measure the effect of blower speed on energy consumed by it.

5.1 INTEGRATIVE COMMUNICATION

L T P

- - 4

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No	. Units	Cover	age	Time
		L	Т	Р
1.	Introduction to Personality Development	_		02
2.	Factors Influencing / Shaping Personality	-	-	02
3.	Self Awareness - 1	-	-	03
4.	Self Awareness - 2	-	-	02
5.	Self Awareness - 3	-	-	02
6.	Change Your Mind Set	-	-	02
7.	Interpersonal Relationship and Communication	-	-	03
8.	Non-Verbal communication Communication Skills	s –	-	02
9.	Communication Skills ACTIVITIES	-	-	06
10.	Body Language skills	-	-	03
11.	Leadership Traits & Skills	-	-	03
12.	Attitude	-	-	03
13.	Analyzing & Solving a Problem skills	-	-	02
14.	Time Management skills	-	-	03
15.	Stress Management Skills	-	-	02
16.	Interview Skills	-	-	04
17.	Conflict Motives	-	-	02
18.	Negotiation / Influencing Skills	-	-	02
19.	Sociability	-	-	03
20.	Importance of Group	-	-	03
21.	Values / Code of Ethics	-	-	02
				FC
		-	-	56

PERSONALITY DEVELOPMENT

	1 Introduction to Personality Development AIM, Skills, Types of Skills, LIFE SKILLS VS OTHER SKILLS, Concept of Life Skills. Ten core Life Skills identified by WHO					
2.	Factors Influencing / Shaping Personality :					
	Introduction, Physical and Social Factors Influencing / Shaping					
	Personality (Hereditary, Self-Development, Environment,					
	Education, Life-situations) Psychological AND Philosophical					
	Factors Influencing / Shaping Personality (Past Experiences,					
	Dreams and Ambitions, Self-Image, Values)					
3.	Self Awareness - 1					
	DIMENSIONS OF SELF AWARENESS (Self Realization, Self					
	Knowledge or Self Exploration, Self Confidence, Self Talk, Self					
	Motivation, Self Esteem, Self Image, Self Control, Self					
	Purpose, Individuality and Uniqueness, Personality, Values,					
	Attitude, Character), SELF REALIZATION AND SELF EXPLORATION					
	THROUGH SWOT ANALYSIS AND JOHARI WINDOW,					
4.	Self Awareness - 2					
	SYMPATHY VS EMPATHY AND ALTRUISM,					
	Importance ofEmpathizing with Others,					
5.	Self Awareness - 3					
	Self-Awareness through Activity, Body Image (What is Body					
	~-					

Image, What Decides our Body Image, What is Poor Body Image, What are the Harmful Effects of Poor Body Image), Tackling Poor Body Image(Enhance Self-Esteem, Build Up Critical Thinking, Build up Positive Qualities, Understand Cultural Variation, Dispel Myths, Utilize Life Skills)

6. Change Your Mind Set

What is Mindset, HOW TO CHANGE YOUR MINDSET (Get the Best Information Only, Make the best people your Role Model, Examine Your Current Beliefs, Shape Your Mindset with Vision and Goals, Find Your Voice, Protect Your Mindset, Let Go of Comparisons, Put An End To Perfectionism, Look At The Evidence, Redefine What Failure Means, Stop Worrying About What "People" Think)

INTERPERSONAL SKILLS

7. Interpersonal Relationship and Communication

INTERPERSONAL RELATIONSHIP, Forms of Interpersonal Relationship, Must Have in an Interpersonal Relationship, Interpersonal Relationship between a Man and a Woman (Passion, Intimacy, Commitment), Relationship Between Friends, ROLE OF COMMUNICATION IN INTERPERSONAL RELATIONSHIP (Take Care Of Your Tone And Pitch, Choice of Words is Important in Relationships, Interact Regularly, Be Polite, Try To Understand The Other Person's Point Of View As Well, Individuals Can Also Communicate Through Emails,

8. NON-VERBAL COMMUNICATION Communication Skills

Non-Verbal Communication,

We Communicate with Our Eyes, Communication with Facial Expression, A Good Gesture, Appearance, Posture and Gait, Proximity and Touch), IMPORTANCE OF LISTENING, Characteristics of Good and Effective Listener(Is Attentive, Do Not Assume, Listen for Feelings and Facts, Concentrate on the Other Speakers Kindly and Generously, Opportunities)

9. Communication Skills ACTIVITIES -

Activities in Making Collages, Making Advertisements, PPT Preparation & Presentation, Speaking -Seminars, Group Discussions, Debates, Extempore Speeches, Listening to an audio clip and telling its gist, Answering a telephone call, Making enquiries, General tips-Pronunciation, Tone, Pitch, Pace, Volume, relevance, brief, simple Reading Newspaper, Magazines (Current Affairs, Economic magazines, Technical magazines), How to read a report, article, Writing- Resume Writing, Writing joining report, Notice writing, Report making, Proposal writing, Advertisement, Notice for tender, Minutes writing, E-Mail writing, Listening News, Listening to audio clips.(Lecture, poetry, speech,

songs),

10. Body Language skills

Introduction, What is Body Language , Body Language Parts, Personal Space Distances (Intimate Distance, Personal Distance, Social Distance, Public Distance), IMPORTANT BODY LANGUAGE SIGNS AND THEIR MEANING

UNDERSTANDING OTHERS

11. Leadership Traits & Skills :

Introduction, Important Leadership Traits (Alertness, Bearing, Courage, Decisiveness, Dependability, Endurance, Enthusiasm, Initiative, Integrity, Judgment, Justice, Knowledge, Loyalty, Sense of Humour), Other Useful traits (Truthfulness, Esprit-de-corps, Unselfishness, Humility and sympathy, Tact without loss of moral

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courage, Patience and a sense of urgency as appropriate, Selfconfidence, Maturity, Mental including emotional stability)

12. Attitude

Types of Attitude, Components of Attitudes (Cognitive Component, Affective Component, Behavioral Component), Types of Attitudes (Positive Attitude, Negative Attitude, Neutral Attitude, Rebellious Attitude, Rational and Irrational Attitudes, Individual and Social Attitudes), Kinds of Attitude, ASSERTIVENESS, How to Develop Assertiveness (Experiment and Try New Things, Extend Your Social Circle, Learn to Make Decisions for Yourself, Indulge in Knowledge, Admire Yourself & Others), Negotiation (Be Sensitive to The Needs Others, Be Willing To Compromise, Develop Your Problem-Solving Skills, Learn to Welcome Conflict, Practice Patience, Increase Your Tolerance For Stress, Improve Your Listening Skills, Learn To Identify Bottom-Line Issues Quickly, Be Assertive, Not Aggressive)

PROBLEM SOLVING

13. Analyzing & Solving a Problem skills

Critical Thinking, Creative Thinking, Decision Making, Goal Setting & Planning, Problem Solving

14. Time Management skills

Need of Time Management, TIME WASTERS (Telephone, Visitors, Paper work, Lack of Planning & Fire Fighting, Socializing, Indecision, TV, Procrastination), PRINCIPLES OF TIME MANAGEMENT - Develop a Personal Sense of Time (Time Log, value of other people's time), Identify Long-Term Goals, Concentrate on High Return Activities, Weekly & Daily Planning (The Mechanics of Weekly Planning, Daily Planning), Make the Best Use of Your Best Time, Organize Office Work (Controlling Interruptions, Organizing Paper Work), Manage Meetings, Delegate Effectively, Make Use of Committed Time, Manage Your Health,

15. Stress Management Skills

INTRODUCTION, Understanding Stress and its Impact, Expected Responses (Physical, Emotional, Behavioral), stress signals(thoughts, feelings, behaviors and physical), STRESS MANAGEMENT TECHNIQUES (Take Deep Breath, Talk It Out, Take A Break, Create a Quite Place in Your Mind, Pay Attention to Physical Comfort, Move, Take Care of Your Body, Laugh, Mange Your Time, Know Your Limits, Do You Have To Be Right Always, Have A Good Cry, Look for the Good Things Around You, Talk Less, Listen More), UNDERSTANDING EMOTIONS AND FEELINGS-through Activity

16. Interview Skills (2 sessions from Industry Expert is Compulsory) Curriculum Vitae (When Should a CV be Used, What Information Should a CV Include, personal profile, Covering Letter, What Makes a Good CV, How Long Should a CV Be, Tips on Presentation), Different Types of CV (Chronological, Skills-Based), BEFORE THE INTERVIEW , CONDUCTING YOURSELF DURING THE INTERVIEW , FOLLOWING THROUGH AFTER THE INTERVIEW , Interview Questions To Think About , MOCK INTERVIEW - Activity (MOCK INTERVIEW EVALUATION - NON-VERBAL BEHAVIORS, VERBAL

 $\ensuremath{\mathsf{BEHAVIORS}}$, General Etiquettes to face the Board , Telephonic interview

17. Conflict Motives -Resolution

Motives of Conflict(Competition for Limited Resources, The Generation Gap and Personality Clashes, Aggressive

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Personalities, Culturally Diverse Teams, Competing Work and Family Demands, Gender Based Harassment), Merits and Demerits of Conflict, Levels of Conflict (Interpersonal Conflict, Role Conflict, Inter-group Conflict, Multi-Party Conflict, International Conflict), Methods of Conflict Resolution (The Win-Lose Approach, The Lose-Lose Strategy, The Win-Win Approach), Techniques for Resolving Conflicts (Confrontation and Problem Solving Leading to Win-Win, Disarm the Opposition, Cognitive Restructuring, Appeal to Third Party, The Grievance Procedure)

$18.\ {\rm Negotiation}\ /\ {\rm Influencing\ Skills}$

Why Influencing, What Is Influencing, TYPES OF INFLUENCING SKILLS (Probing And Listening, Building Rapport, Sign Posting, Pacing, Selling, Assertiveness), LAWS AND PRINCIPLES OF INFLUENCE, The Six Laws of Influence (The Law of Scarcity, The Law of Reciprocity, The Law of Authority, The Law of Liking, The Law of Social Proof, The Law of Commitment and Consistency), Influencing Principles (Making a Start, Buy Yourself Thinking Time, Dealing With Disagreement, Difficult And Sensitive Situations)

19. Sociability : Etiquettes And Mannerism & Social Skills

Need for Etiquette , Types of Etiquettes (Social Etiquette, Bathroom Etiquette, Corporate Etiquette, Wedding Etiquette, Meeting Etiquette, Telephone Etiquette, Eating Etiquette, Business Etiquette, E-Mail Etiquettes,), MANNERISMS, HOW TO IMPROVE YOUR SOCIAL SKILLS (Be Yourself, Be Responsible, Be Open & Approachable, Be Attentive, Be Polite, Be Aware, Be Cautious)

20. Importance of Group / Cross Cultural Teams / Team Work skills Introduction, Types and Characteristics of Groups (Definition of a Group, Classification / Types of Groups, Friendship Group, Task Group, Formal Groups, Informal Group, Effective Group), Importance of a Group, Characteristics of a Mature Group, TYPES AND CHARACTERISTICS OF A TEAM (Definition of a Team, Types of Teams, Functional Teams, Problem Solving Teams, Cross - Functional Teams, Self - Managed Teams), Importance of a Team, Characteristics of a Team

21. VALUES / CODE OF ETHICS

Meaning, A FEW IMPORTANT VALUES (Honesty, Integrity, Purity, Discipline, Selflessness, Loyalty, Fairness, Equality, Trust, Support, Respect, etc)

Note : One Orientation module for the faculty is must. Involvement of Industry Experts is necessary for Interview Skills

5.2 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L T P 6 2 -

RATIONALE

The knowledge of this subject is required for all engineers/technicians who wish to choose industry/field as their career. This course is designed to develop understanding of various functions of management, role of workers and engineers and providing knowledge about industrial and tax laws.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Cove	rage '	Time	
		L	Т	Ρ	
1.	Principles of Management		8	_	-
2.	Human Resource Development		10	-	-
3.	Wages and Incentives		4	-	-
4.	Human and Industrial Relations		6	-	-
5.	Professional Ethics		2	-	-
6.	Sales and Marketing management		10	-	-
7.	Labour Legislation Act		10	-	-
8.	Material Management		8	-	-
9.	Financial Management		8	-	-
10.	Entrepreneurship Development		8	-	-
11.	Fundamental of Economics		5	-	-
12.	Accidents and Safety		5	-	-
		84	_	_	

DETAILED CONTENTS

1. Principles of Management

- 1.1 Management, Different Functions: Planning, Organising, Leading, Controlling.
- 1.2 Organizational Structure, Types, Functions of different departments.
- 1.3 Motivation: Factors, characteristics, methods of improving motivation, incentives, pay, promotion, rewards, job satisfaction, job enrichment.
- 1.4 Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader, promoting team work.

2. Human Resource Development

- 2.1 Introduction, objectives and functions of human resource development (HRD) department.
- 2.2 Recruitment, methods of selection, training strategies and career development.
- 2.3 Responsibilities of human resource management policies and functions, selection - Mode of selection - Procedure - training of workers, Job evaluation and Merit rating.

3. Wages and Incentives

- 3.1 Definition and factors affecting wages, methods of wage payment.
- 3.2 Wage incentive type of incentive, difference in wage, incentive
 - and bonus; incentives of supervisor.
- 3.3 Job evaluation and merit rating.

4. Human and Industrial Relations

- 4.1 Industrial relations and disputes.
- 4.2 Relations with subordinates, peers and superiors.
- 4.3 Characteristics of group behaviour and trade unionism.
- 4.4 Mob psychology.
- 4.5 Grievance, Handling of grievances.
- 4.6 Agitations, strikes, Lockouts, Picketing and Gherao.

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- 4.7 Labour welfare schemes.
- 4.8 Workers' participation in management.

5. Professional Ethics

- 5.1 Concept of professional ethics.
- 5.2 Need for code of professional ethics.
- 5.3 Professional bodies and their role.

Sales and Marketing management 6.

- 6.1 Functions and duties of sales department.
- 6.2 Sales forecasting, sales promotion, advertisement and after sale services.
- 6.3 Concept of marketing.
- 6.4 Problems of marketing.
- 6.5 Pricing policy, break even analysis.
- 6.6 Distribution channels and methods of marketing.

7. Labour Legislation Act (as amended on date)

- 7.1 Factory Act 1948.
- 7.2 Workmen's Compensation Act 1923.
- 7.3 Apprentices Act 1961.
- 7.4 PF Act, ESI Act.
- 7.5 Industrial Dispute Act 1947.
- 7.6 Employers State Insurance Act 1948.
- 7.7 Payment of Wages Act, 1936.
- 7.8 Intellectual Property Rights Act

8. Material Management

- 8.1 Inventory control models.
- 8.2 ABC Analysis, Safety stock, Economic ordering quantity.
- 8.3 Stores equipment, Stores records, purchasing procedures, Bin card, Cardex.
- 8.4 Material handling techniques.

9. Financial Management

- Importance of ledger and cash book. 9.1
- 9.2 Profit and loss Account, Balance sheet.
- 9.3 Interpretation of Statements, Project financing, Project appraisal,

return on investments. Entrepreneurship Development 10.

- 10.1 Concept of entrepreneur and need of entrepreneurship in the context of prevailing employment conditions.
- 10.2 Distinction between an entrepreneur and a manager.
- 10.3 Project identification and selection.
- 10.4 Project formulation.
- 10.5 Project appraisal.
- 10.6 Facilities and incentives to an entrepreneur.

Fundamental of Economics 11.

- 11.1 Micro economics.
- 11.2 Macro economics.
- Accidents and Safety 12.
 - 12.1 Classification of accidents based on nature of injuries, event and place.
 - 12.2 Causes and effects of accidents.
 - 12.3 Accident-prone workers.
 - 12.4 Action to be taken in case of accidents with machines, electric shock, fires and erection and construction accidents.
 - 12.5 Safety consciousness and publicity.

 - 12.6 Safety procedures.12.7 Safety measures Do's and Don'ts and god housing keeping.

5.3 HEAT TRANSFER OPERATIONS

L T P 5 1 3

Rationale:

The subject already dealt as mechanical operations & Solid handling fluid mechanics in first and second year was the fundamentals. To further study the subject Heat transfer Operations is included to get the knowledge of modes of Heat transfer like conduction, convection and radiation. Different heat exchangers, condensers, evaporators, crystalysers, insulators used in chemical plant. Different types of simple numerical will be dealt to get the chemical engineering students aware of the problems generally occuring the industries.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.N	No. Units		Cove	rage	Time
			L_	T_	P
1			F	1	
⊥.	Modes of Heat transfer		5	T	
2.	Conduction.		8	2	
З.	Convection.		8	2	
4.	Radiation.		8	2	
5.	Heat Exchanger		8	2	
6.	Condenser.		8	2	
7.	Evaporaters.		8	1	
8.	Crystalliysers.		8	1	
9.	Insulation.		9	1	
		Total	70	14	52

DETAILED CONTENTS

1. MODES OF HEAT TRANSFER:

Conduction, convection & radiation.

2. CONDUCTION:

Fourier's law, Thermal conductivity, Conductance, flat Wall, Multilayer flat wall, Hollow cylinder, Multilayer cylinder log mean area, geometric mean area & Arthmatic mean area, Simple numerical problems in S.I. Units.

3. CONVECTION:

Natural and froced convection, Physical significance of dimension less number. Reynold No, Prandle No., Nusselt No., Stanton No., Peclet No., Grashoff No., Dittus Boelter's equation-simple numerical problems using Dittus Boelter equation. Fouling factor. Individual heat transfer coefficient and over all heat transfer coefficient.

4. RADIATION:

Reflection, absorption and transmission of radiation, Kirchoff law, Emissive power, Wein's displacement law, the stefen Boltman law, Heat transfered by radiation exchange of energy between two parallel planes of difference emissivity, Radiant Heat transfer coefficient, Solar radiation, gray surfaces or gray body.

5. HEAT EXCHANGERS:

Log.-Mean-temp.-Difference (L.M.T.D.) for parallel or cocurrent - flow, counter-current-flow, cross - flow, construction and description of

- 1. Double pipe heat exchangers.
- Shell & Tube heat exchanger.
 Finned tube heat exchangers. Scale formation and cleaning devices, Wilson's plot (Simple Numerical Problems).
- 4. Plate type heat exhanges.
- 6. CONDENSER: Film-wise and Drop-wise condensation. Construction & description of contact condenser and surface condenser.
- 7. EVAPORATORS: Construction and description of
- 1. Horizontal tube types.
- 2. Standard vertical type or calendria type.
- (a) Natural and forced circulation type.
- (b) Entrainment and foam formation.
- (c) Method of feeding evaproators-Forward, Backward & cross, mixed multi effect evaproation.
- (d) BOILING : Nucleare boiling, film boiling, Transition boiling, Maximum flux and critical temperature drop, construction & description of Kettle type boilers. Boiling point rise (B.P.R) and effect, steam economy for single effective evaporator (Simple Numerical Problem).

8. CRYSTALLIZERS:

- Classification of crystallizers; construction and description of 1. Swensen walker.
- 2. Vacuum crystalizer.
- 9. INSULATION:

Purpose of insulation common insulators, critical thickness of insulation for cylinder and spheres, optimum thickness of insulation, Heat loss from a pipe. REFERENCE BOOKS

- 1. Heat Transfer by D. Q. Kern
- 2. Unit Operating in Chemical Engineering by Mc Cabe & Smith
- 3. Introduction to Chemical Engineering by Badger & Bancaro

L T P 5 1 3

Rationale:

It is the further step of Unit Operation deals with the gas absorption, distillation, boiling point diagrams, extraction operation, humidification and drying processes in chemical industry. The subject have experiments as well, to be aware of the facts involved in actual process.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.I	No. Units		Cove	rage	Time
			L	Т	Р
1.	Diffusion		10	2	_
2.	Absorption		15	3	-
3.	Distillation		15	3	-
4.	Extration		15	3	-
5.	Humidification		10	2	_
6.	Drying		5	1	-
		Total	70	14	42

DETAILED CONTENTS

1. DIFFUCION:

Definition of diffusion, Rate of diffusion in Mass Transfer, Fick's law, diffusion in the gas phase-Equimolecular counter diffusion, diffusion through a stationary gas (Stefan's Law), Mass. Transfer Coefficient. Film theory and penetration theory of Mass Transfer, Diffusion in solids. Derivation of the following relations.

- I. 1 1 m ---- = ---- + -----KG.a kG.a kL.a
- 2. ABSORPTION:

Introduction, importance, absorption with chemical reaction, Mechanism of absorption - two film theory, Diffusion of gases through a stagnant gas, Diffusion in liquid phase, Rate of absorption, Relation between film and overall coefficient, Factors influencing the transfer coefficient. Gas absorption equipments - Plate and packed calumn, Spray towers, Choice of solvent for absorption, Height of Transfer Unit (HTU), Number of Transfer Unit (NTU), Meaning and their relationship (Simple Numerical Problems).

3. DISTILLATION:

Various distillation methods:-

- Equilibrium or flash distillation . 1.
- Differential distillation 2.
- 3. Batch distillation.
- Vacuum and Steam distillation. 4.
- 5. Azeotropic and Extractive distillation.

Types of distillation columns:-

- 1. Perforated plate or sieve plate column
- 2. Bubble cap plate column

Vapor liquid equilibrium diagram, Raoult's law; Relative volatility, constant boiling mixtures, equilibirium diagram and construction of equilibrium diagram, Fractionating column calculation- Heat & material balance, Reflux ratio, equilibrium plate, Location of feed plate. Sub cooled reflux; effect of reflux ratio, Total reflux, Minimum reflux ratio Entrainment; Mc-Cable Thiele diagram-section above and below feed plate; Intersection of operating line. Location of q-line, optimum reflux ratio, calculation of no. of equilibrium plate by Mc-Cable Thiele diagram. Overall plate efficiency.

- 4. EXTRACTION :
 - Applications of this operation.
 Choice of solvent.

 - 3. Steps of extraction operation
 - 4. Solid Liquid extraction, construction and description of
 - Moving Bed-Basket type oil seed extractor Α. or Bollman extractor.
 - Rotocel extractor. в.

Liquid extractor; description and construction of

- Α. Mixer settler extraction system.
- в. Perforated plate and baffle towers.
- 5. HUMIDIFICATION:

Definition and calculation of

- 1. Humidity
- 2. Percentage humidity
- 3. Relative humidity

- 4. Humid volume.
- 5. Humid heat.
- 6. Enthalpy and its calculation.
- 7. Dry bulb and wet bulb-temp.
- 8. Adiabatic saturation temperature.
- Use of humidity chart. Dew point, simple numerical problem using humidity chart, construction and description of cooling towers. (Natural and induced draft)
- 6. DRYING

General drying behaviour-Critical moisture content, equilibrium moisture content: Discription and construction of dryer.

- 1. Tray dryer.
- 2. Screen conveyor dryer.
- 3. Rotary dryer.

NOTE:- At Least One Question From Each Topic.

REFERENCE BOOKS

- 1. Mass Transfer Operation by R. Treybal
- 2. Chemical Engineering Vol. II by Richardson & Coulson
- 3. Unit Operation of Chemical Engineering by Mc Cabe & Smith
- 4. Introduction To Chemical Engineering by Badger & Bancher
HEAT & MASS TRANSFER LAB.

LIST OF EXPERIMENT

(At Least 7 experiment to be Performed)

- 1. To determine over all heat transfer coefficient for an open pan evaperater in steady state conditions.
- 2. To determine over all heat transfer coefficient for an open pan evaporater in unsteady state conditions.
- 3. To determine 'U' for a double pipe heat exchanger in steady state conditions and also to determine efficiency of heat utilization.
- 4. To determine 'U' for a shell and tube heat exchanger in steady state conditions and also to determine efficiency of heat utilization.
- 5. To study a shieve plate distillation operation and to calculate over-all efficiency of the distillation column.
- 6. To determine steam economy of a single and double effect evaporator.
- 7. To study the rate of drying in a vacuum dryer.
- 8. To determine the pounds of volatile compounds distilled per unit pounds of steam distilled in a steam distillation operation.
- 9. To determine rate of setting of crystals in a crystaliser.
- 10. To study the rate of drying in Rotary dryer.
- 11. To determine drying rate for a wet material in a Tray Dryer.
- 12. To study packed tower in various industries.
- 13. To study various extractors in solvent extraction plant.
- 14. To study a spray pond in suger and other industries for cooling system.
- 15. Determination of Thermal conductivity of Asbestus Powder.
- 16. Study of Insulating Material (Glass wool, Mineral wool, Ceramic blanket, Fire brik, Fire cement, Fire clay, Asbestus power, Fire crete)

5.5-POLLUTION CONTROL & INDUSTRIAL SAFETY

L T P 4 1 -

Rationale:

A chemical engineering technician must have the knowledge of different types of pollution caused due to industrialsation so that he may help in balancing the eco-system and control the pollution by means of control devices. The technician must know various types of accidents which occour in chemical plants and how to safe gaurd them to avoid injury to men and material. The content of the subject have been developed to cater the above needs.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Cove	Coverage I			
		L	Т	Ρ		
1.	Introduction	6	1			
2.	Air Pollution	6	1	-		
3.	Water Pollution	6	2	-		
4.	Environment Protection	6	2	-		
5.	Radioactive Pollution	6	2	-		
6.	Solid Waste Management	6	1	-		
7.	Pollution Acts	6	2	-		
8.	Safety in Chemical Industry	6	2	-		
9.	Disaster Management	6	1	-		
	Total	84	28			

DETAILED CONTENTS

1. INTRODUCTION:

What is environment ? What is Pollution? Classification of pollution e.g. Land, Water, Air, Noise. Impact assessment of development projects. Character and origin of industrial wastes.

2. AIR POLLUTION:

- (i) Definition of air pollution, Types of Air pollutants and their sources like SPM, SOX, NOX, NH3, F, Cl, CFC, Co2 etc.
- (ii) Air pollution control equipment in industries.
 - (a) Settling chambers
 - (b) Cyclones
 - (c) Scrubbers (dry & wet)
 - (d) Multiclones
 - (e) Electro Static Precipitations (ESPS)
 - (f) Bug Filters

(iii) Ambient air quality measurement & their standards.(iv) Vehicular Pollution and its control(v) Noise Pollution and its control mechanism.

3. WATER POLLUTION:

Water pollution, standards for drinking water, domestic waste water and industrial waste water. Methods of measurement of various parameter like BOD, SS, pH, COD, TDS etc. Methods of treatment of industrial waste water like

- (a) Chemical treatment
- (b) Physio-Chemical treatment
- (c) Bio-chemical treatment
- (d) Any other advance treatment
- 4. ENVIORNMENT PROTECTION :

Enviornmental protection from hazardeous Chemicals & Waste :-

Terminology relating to chemical hazards and air pollution, classification of chemical hazards and hazardous chemicals, codes of safety for operational hazards in laboratories, industries etc. (Reference should be made of I.S. Codes)

5. RADIO ACTIVE POLLUTION:

Sources and effect on human, animal, plant and material. Measurement, means to control, preventive measures.

6. SOLID WASTE MANAGEMENT:

Municipal solid waste, Biomedical waste, Plastic waste and Its Management.

7. POLLUTION ACTS:

A water pollution prevention control Act 1974, Air pollution Act 1981, Environment protection Act 1986, Hazardous chemical manufacturing, Storage and impact rules 1989 and hazardous waste and management and handling rules 1989, Noise Pollution Act.

8. SAFETY IN CHEMICAL INDUSTRY:

Receiving and storing chemicals-Transporting and moving chemicals- Safety in chemical reactions, Pipe-lines in chemical factories. Precautions in the case of processes in operations involving explosive or inflammble dusts, gases, vapours etc. Maintenance of chemical plants-corrosion health

hazards in common chemical processes, Fire hazards and their Prevention. Codes of practice and specification for safety equipment (Reference should be made from I.S. Codes).

9. DISASTER MANAGEMENT :

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benifit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

REFERENCE BOOKS

- 1. Safety in Process Plant Design by Wells
- Safety and Accident Prevention in Chemical Operation by H. H. Tawcatte and W S Wood
- 3. Engineering Chemistry by P. C Jain

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L T P
5 1 -
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Rationale:

Crude oil is the raw material for a refinery. Various processes are envolved in the production of petroleum products. A student having knowledge of Distillation, thermal Carcking, Catalytic Cracking for producing Lube oil, Bitumen and many other products will be useful for petroleum refining industry.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.1	Sl.No. Units Covera		rage	Time
		L	Т	Ρ
1.	Introduction	5	1	_
2.	Crude Oil	5	1	_
3.	Petroleum Product	10	2	_
4.	Distillation	10	2	_
5.	Thermal Cracking	10	2	_
6.	Catalytic Cracking Process	10	2	_
7.	Manufacture of Lube Oil Base Stock	10	2	_
8.	Buitumen	10	2	-
	Total	70	14	

DETAILED CONTENTS

1. INTRODUCTION:

India and global status of petroleum and natural gas, future prospects and availability of processing technology.

2. CRUDE OIL :

Chemistry and Composition, crude oil evaluation, Laboratory distillation (ASTM, TBP, EFV).

3. PETROLEUM PRODUCT :

Composition, uses and Indian specification of LPG, Naptha, MS, Kerosine, ATF, HSD, LDO, Bitumen, Waxes, Petroleum Cokes, Lubricating oil.

4. DISTILLATION :

Distillation of crude oil, Atmospheric distillation, Vacuum distillation.

5. THERMAL CRACKING :

Coking process, Fluid coking, Delayed coking, Visbreaking.

6. CATALYTIC CRACKING PROCESS :

Catalytic reforming, Hydrocracking, Alkalization isomerisation, Polymerization.

7. MANUFACTURE OF LUBE OIL BASE STOCK :

Solvent Deashphalting, Solvent extraction, Solvent dewaxing, Hydrofinishing, Manufacture of waxes (Paraffin and Microcrystalline).

8. BITUMENT :

Manufacturing of Bitumen.

VI SEMESTER

6.1 CHEMICAL REACTION ENGINEERING (CRE)

L T P 5 1 -

Rationale:

Chemical reaction engineering is concerned with all those engineering activities which involves exploitation of chemical reactions on a commercial scale.

The subject involves homogeneous chemical reactions and their equilibrium, chemical kinetics and types of reactor hetrogenous reaction.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No	Sl.No. Units		Coverage	
		L	Т	P
1.	Introduction	5	1	_
2.	Homogenous Reactions	15	3	_
3.	Interprtation of constation volume batch	15	3	_
	reactor data			
4.	Ideal Reactors	15	3	_
5.	Introduction to Heterogenous reacting systems	15	2	_
6.	Introduction of Various Types of Industrial	10	2	_
	reactor			
	Total	70	14	_

DETAILED CONTENTS

1. INTRODUCTION :

Chemical kinetics, classification of reactions variables affecting the rate of reaction;

2. HOMOGENEOUS REACTIONS :

Concentration dependent term of a rate equation, single and multiple reaction, series and parallel reactions. Elementary and Non-elementary reactions, Kinetic view for elementary reactions molecularity and order of reaction, Rate constant K. Representation of a reaction rate, Temperature dependant term of a rate equation, Temperature dependancy from - (Arrhenius law, Thermodynamics and collision theory). Activation energy and Temperature dependency. Simple

numerical problems.

3. INTERPRETATION OF CONSTANT VOLUME BATCH REACTOR DATA :

Constant volume batch reactor-Integral method of Analysis of data, Differential method of analysis of data temperature and Reaction rate. The search for a rate equation. Simple Numerical problems.

4. IDEAL REACTORS :

Classification of reactors and application & their comparision, Ideal batch reactor, space time and space velocity, steady-state mixed flow reactor, steady state plug flow reactor. Holding time and space time for flow systems. Simple numerical problems.

5. INTRODUCTION TO HETROGENEOUS REACTING SYSTEMS :

Rate Equation for Hetrogeneous Reactions. Contacting pattern for two phase system Simple Numerical problems.

6. INTRODUCTION OF VARIOUS TYPES OF INDUSTRIAL REACTORS :

CSTR, Tricle, Sheray, Packed bed, Fludizer bed.

REFERENCE BOOKS

- 1. Chemical Engineering Kinetics by J. M. Smith
- 2. Chemical Reaction Engineering by Octave Levenspal
- 3. Reaction Engineering by Walas
- 4. Chemical Reaction Engineering I & II by K. A. Gawhane

6.2-AUTOMATIC PROCESS CONTROL

L T P 6 2 6

Rationale:

The subject automatic process control deals with the different types of controls in process in chemical industries including automatic control system. Process characteristics is of first order that is time constant element and second order that is oscillatroy type element. Different modes of control action and closed loop in automatic control are well known. The student will be well conversent with these processes.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.1	Sl.No. Units		Coverage		
		L	Т	Ρ	
1.	Introduction	10	3_		
2.	Elements of control system	10	3	-	
3.	Process Characterstics	16	5	-	
4.	Controller Characteristics	12	3	-	
5.	Closed loop in Auto control	12	4	-	
6.	Programmable Logic Controller	12	4	-	
7.	Distributed Control System	12	4	_	
	Total	84	28	84	

DETAILED CONTENTS

1. INTRODUCTION:

What is Automatic control, Advantage of Automatic control, manual and automatic control, physical and block diagram.

2. ELEMENTS OF CONTROL SYSTEM:

Definition-Input means, controlling means, actuating means, measuring means, final control elements.

3. PROCESS CHARCTERISTICS:

Process variables, process degree of freedom, forcing function, step fn., ramp, impulse, sinusiodal function, laplace transformation.

Elements of process dynamics: - Proportional, Capacitance.

Time constant and oscillatory element, determination of system function or transfer function of the following:- (Sketch physical diagram and block diagram)

- (a) Ist order system or time constant element:-
 - (i) Naked bulb thermometer.
 - (ii) Stirred tank heater.
 - (iii) Mixing process.
 - (iv) R.C. Circuit.
 - (v) Liquid levels.
 - (vi) Two time constant type liquid vessel cascaded i.e. Non interacting and non cascaded, i.e. interacting
 - (vii) Contionuous stirred tank chemical reactor with Ist order chemical reaction.
- (b) IInd order system or oscillatory type element.

(i) Bulb in thermowell.
(ii) Mechanical damper.
(iii) Fluid manometer or U tubes.
Response of Ist order system to step, ramp, impulse and sinusoidal inputs, Response of IInd order systsm to step change (Transient response).

4. CONTROLLER CHARACTERISTEIC OR MODES OF CONTROL ACTION:

Elements of controller, proportional control, Integral control, proportional-integral control, proportional derivative control, proportional-integral-derivative control, Two positions control.

5. CLOSED LOOP IN AUTOMATIC CONTROL:

Standard block diagram symbol , overall transfer fn. for a single loop system, overall transfer function for change in set point and for change in load, overall transfer fn. multi loop control system, unit step response of the following.

(i) Proportional control at stirred tank heater for set point change and for load change.

- (ii) P.I control of stirred tank heater for set point change and load change.
- 6. PROGRAMMABLE LOGIC CONTROLER (PLC):

Introduction, Principle of operation, Architecture of programmable controller, Programming the programmable controler, Application of programmable control.

7. DISTRIBUTED CONTROL SYSTEM (DCS) :

Real time computer control system - concept, functional requirements of distributed process control system, configuration some popular DCS.

REFERENCE BOOKS

- 1. Process System Analysis and Control by Coughnowr and Koppel
- 2. Chemical Process Control by George Stephanopalous
- 3. Computer Control of Industrial Process by S. Savas, Emenule
- 4. Industrial Instrumentation by D. P. Eckman

AUTOMATIC PROCESS CONTROL LAB

LIST OF EXPERIMENT

(At Least 8 experiment to be Performed)

- 1. To measure time constant of a single capacity thermal process (water bath & heater).
- 2. Caliberation of thermo couple.
- 3. To study the transient response of first order system (thermo couple) and find out time constant.
- 4. To study the transient resposne of a simple R-C network and plot Bodey's diagram.
- 5. To study on of type water level control and to find out steady state voltage.
- 6. To study the frequency response of a second order electrical circuit equipment to a physical system (R-L-C network).
- 7. Caliberation of pressure Gauge by Dead Weight tester.
- 8. To study, sketch and operation of strip chart recorder and

Directing pen recorder.

- 9. Claiberation of bimetallic thermometer.
- 10. To study the response of bimetallic thermo meter for a step input and find its time constant.
- 11. To calibrate the pneumatic control valve (Diaphram type).
- 12. To calibrate the given manometer for level measurement.
- 13. To study the response of two tank non interacting liquid level system and two tank interacting liquid level system.
- 14. A study of automatic ON and cut of A.C. supply by a solid state (Built in relay and transformer) voltage stablizer.

6.3 PROCESS EQUIPMENT DESIGN

L T P 4 2 -

Rationale:

The topics included in the subject process equipment design are design of machine elements, storage vessels, pressure vessels with the consideration of stress involved in materials and their protective coatings. The student are expected to solve the elementary problems of different equipments used in process industry.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Сс	ove	rage	Time
			L	Т	Ρ
1.	Basic Engineering Materials		3	2	_
2.	Basic Considerations Process Equipment	Design	3	3	-
3.	Design Considerations		8	4	-
4.	Power Requirement of Pumps		8	4	-
5.	Pressure Vessels		8	4	-
6.	Distillation Column	-	12	4	
7.	Heat Exchangers & Condensers		8	4	-
8.	Evaporators		6	3	-
	Total		56	28	_

DETAILED CONTENTS

1. BASIC ENGINEERING MATERIALS:

Ferrous Materials, Non Ferrous materials, Synthetic Materials, Natural materials.

2. BASIC CONSIDERATIONS IN PROCESS EQUIPMENT DESIGN :

Introduction, General Design Procedures, Fabrication Techniques, Equipment Classification, Power for rotational motion.

3. DESIGN CONSIDERATIONS

Introduction ,Materials Selections, Corrosion Prevention, Stresses Created due to Static & Dynamic Loads, Elastic Instability, Combined Stresses and Theories of Failure, Fatigue, Brittle, Fracture, Creep, Temperature Effect, Radiation Effects, Effects of Fabrication Methods, Economic

Conisideration.

4. POWER REQUIREMENT OF PUMPS:

Problems relating calculations of horse power (H.P.), N.P.S.H., for flow of incompressible fluid.

5. PRESSURE VESSELS:

Selection of type of vessels and storage tank, criteria of selection,

Fixed head and floating head type storage tanks, causes of failure

of vessels, methods of fabrication, types of formed heads, stress in

thin shells subjected to internal pressure, Longitudinal and cirumfrential stress, joint efficiency and corrosion allownance, Crown and Knuckle radius, Problems relating calculation of shell thickness of cylindrical and spherical shells, Thickness of Torispherical heads subjected to internal pressure as per I.S. code. Problems associated with tank and vessels.

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6. DISTILLATION COLUMN:
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Preparation of equilibrium diagram, Problems relating calcualtion of theoretical plates at a given reflux ratio and total reflux, minium reflux ratio, Feed plate location, by McCabe-thiele methods for separation of ideal binary mixtures, Derivation of q-line equation.

7. HEAT EXCHANGER AND CONDENSERS:

Problems relating calculation of L.M.T.D., individual and overall heat-transfer coefficients, Number of tubes, Number of passes, Heat-transfer coefficient for condensing vapors by Wilson's plot.

8. EVAPORATORS:

Problems relating calculation of heating area, Steam requirement, Steam economy for single and double effect evaporators. Methods of feeding evaporators and effect of Boiling Point Rise (B.P.R) and Hydrostatic Head.

REFERENCE BOOKS

- 1. Process Equipment Design by B. E. Brownell & E. M. Young
- 2. Process Heat Transfer by D. Q. Kern
- 3. Mass Transfer Operation by R. E. Treybal
- 4. I. S. Code for Unfire Pressure : IS No. 2825-1969 Pressore Vessel

6.4 PETROCHEMICALS

L T P 5 1 4

Rationale:

Knowledge of various processes is required in the manufacture of Olefines, Armomatics, Detergents, Chemicals and Polymers. A students familiar with the knowledge required in the manufacture of above items will prove useful in the petrochemical industry.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.1	No. Units	Coverage		Time
		L	Т	Р
1.	Introduction	5	1	
2.	Synthesis gas Generation	5	1	-
3.	Manufacture of Olefines	10	2	-
4.	Manufacture of Armomatics	10	2	-
5.	Chemical Used in Detergent Industry	10	2	-
6.	Manufacture of Chemicals for use in	10	2	-
	fibre making			
7.	Manufacture of polymers	10	2	-
8.	Manufacture of Chemicals	10	2	-
	Total	70	14	56

DETAILED CONTENTS

1. INTRODUCTION:

Growth and prospects of petrochemcal industry in India. Introduction to technology of Dehydrogenation, Oxidation, Hydration, Sulphonation, Alkylation, etc.

2. SYNTHESIS OF GENERATION :

Synthesis gas generation through steam reforming and partial oxidation of liquid and gaseous feedstock. Manufacture of Menthol, Oxoalcohol.

3. MANUFACTURE OF OLEFINES :

Naptha pyrolysis and Gas cracking, Manufacture of Acetylene, Ethylene, Propylene, Butanes and their derivatives such as

vinyls, Ethylene oxide, Propylene oxide, Isopropyl Alcohol and Acetone, Acrylonitrile and Buta-diene.

4. MANUFACTURE OF ARMOMATICS :

Products of benzene, Toluene and xylenes from liquid and Gaseous feed stock.

5. CHEMICALS USED IN DETERGENT INDUSTRY :

Manufacture of Linear Alkyl Benzene.

6. MANUFACTURE OF CHEMICALS FOR USE IN FIBRE MAKING :

Caprolactum, dimethyl pathalate, polyester, phthalic anhydride.

7. MANUFACTURE OF POLYMERS :

Polyethylene (Low and High density), Polypropylene, Polymethyl Methacrylate, Polystyrene, teflon, etc.

8. MANUFACTURE OF CHEMICALS :

Dyes, Pharmaceutical, Intermediates and Textile auxiliaries.

PETROCHEMICAL & POLLUTION CONTROL LAB

- 1. Determination of Kinematic Viscosity by Engler Viscometer
- 2. Determination of Smoke point.
- 3. Determination of Penetration Number.
- 4. Laboratory distillation (ASTM, TBT, EFV).
- 5. Determination of Carbon residue-conradson and remsbottom method
- 6. Determination of Cloud and Pour Points.
- 7. Determination of Sulphur.
- 8. Determination of water content by Dean and Stark method.
- 9. Determination of softening point by ring and ball apparatus.
- 10. Determination of pH-value.
- 11. Determination of Turbidity.

- 12. Determination of Total Dissolved Solid (TDS).
- 13. Determination of Dissolved Oxygen (DO).
- 14. Determination of Chemical Oxygen Demand (COD).
- 15. Determination of Biochemical Oxygem Demand(BOD).

PROJECT

6.5 Equipment design project

L T P - - 10

Rationale:

Every diploma holder have to do a project work before going into the world of work so that he may have sufficient knowledge to face the various problems involved in solving the project. Chemical engineering technician must be well aware of these too. So the project on the design of pressure vessel, storage tanks, heat exchanger, distillation column and evaporator are included in the subject.

Every Students is supposed to design one of the following problems alloted by Head of Deptt. and prepare the complete Project Report. The viva - voce will be conducted by the external examiner appointed by the board of Technical Education for the purpose.

The Students should be acquinted with the various codes and standards and the requirements of inspection and safety.

Problem -I.

Design of Pressure Vessel

- (a) Shell
- (b) Head or Cover
- (c) Nozzle
- (d) Flanged Joint
- (e) Support

Problem-II.

Design of Storage Tanks

(a) Material
(b) Bottom Design
(c) Shell Design
(d) Wind graders for open - Top Tanks
(e) Roof - Curb Angles
(f) Self - Supporting Roof Design
(g) Column Supported Roofs
(h) Nozzles and Mountings

Problem - III.

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Design of Heat Exchanger (Shell & Tube)
(a) Shell Design
(b) Shell Cover
(c) Tubes
(d) Tube Sheet
(f) Tie Rods and Spacers
(g) Baffles
(h) Channel
(i) Channel Cover
Problem - IV.
Design of Distillation Column
(a) Shell Thickness
(b) Stresses in Column Shell
(c) Column Internal Details
(d) Head
(e) Support
(f) Tray
Problem - v
Design of Evaporator
(a) Shell design
(b) Shell cover
(c) Tubes
(d) Steam Economy & Heating area
(e) Vacuum creating device
(f) Impingement Baffles
Problem - vi
Exposure of software packages related to chemical engineering
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(a) Calculation of heat exchanger area(b) Calculation of cylindrical area.(c) Conversion volumetric flow rate and similar problems.(d) Conversion of various units.
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And simple programme related to chemical industry

INDUSTRIAL TRAINING/FIELD EXPOSURE

Student have to go for a industrial training of 4 weeks in a chemical industry under the guidance of their H.O.D.. The student will submit a industrial training report which will be scrutinized and examined by the external examiner appointed by the B.T.E.. There will be viva voce of 100 marks and sessional marks 50.

TRAINING SCHEDULE

04 weeks structured supervised branch specific, task oriented Industrial Training to be organised during summer vacation after IInd year examination. The student during the industrial training must under take training in at least any one of the following and submit the training report in the format given at Annexure-I & II.

1. OPERATION OF CHEMICAL PLANT:

Operation of chemical plant, Process control, Management of labour, Material and utility, Safety of workers and equipments.

2. CHEMICAL ANALYSIS:

Analysis of sample, Interpretation of results of analysis.

3. ERECTION & COMMISSIONING OF CHEMICAL PLANT:

Reading and inter-preting the skeches, drawings, layout, planning etc. Erection of chemical plants, Commisioning of chemical plants.

4. INSPECTION & TESTING OF CHEMICAL EQUIPMENT:

Inspection, testing and performance of individual equipment, Fault finding or trouble shooting and its rectification.

STAFF STRUCTURE

THREE YEAR (SIX SEMESTER) DIPLOMA IN CHEMICAL ENGGINEERING (PETROCHEMICAL)

Intake of the O Pattern of the	60 Semester Pattern	
Sl. No.	Name of Post	No.
1.	Principal H.O.D.	1
3.	Lecturer Chemical Engineering	6
5.	Lecturer in Maths	1 Parttime/ Common with
6. 7.	Lecturer in Chemistry Lecturer in Physics	<pre>1 other discip- lines if the 1 intake is more</pre>
8.	Lecturer in Comm. Tech.	than 180 1
9.	Lecturer in Elect. Engg.	1
10.	Computer Programmer	1
11.	Steno Typist	1
12.	Accountant / Cashier	1
13.	Student / Library Clerk	1
14.	Store Keeper	1
15.	Class IV	6
16.	Sweeper	Part time as per requirement
17.	Chaukidar & Mali	as per justification

Note :

1. Services of other discipline staff of the Institute may be utilized if possible

2. Qualifications of Staff : as per service rule

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3. The post of "Computer Programmer" in not needed in the institutions where diploma in "Electronics Engineering" is running.

SPACE STRUCTURE

[A] ADMINISTRATIVE BLOCK

Sl. No.	Details of Space	Floor Area Sg. metres	Remark
1.	Principal's Room	30	
2.	Confidential Room	10	
3.	Steno's Room	6	
4.(a) (b) 5.	Office including Drawing Office Record Room Staff Room	80 20	
	(a) Head 1	15	
	(b) Lecturer 10 sq.m./ Le for 8 Lecturers	ct. 80	
6.	Library and Reading room	150	
7.	Store	100	
8.	Students Common room	80	
9.	Model Room	90	

[B] Academic Block

Sl.No.	Detail of Space	No.	@ Sq.m	Floor Area Sq.m.				
1.	Class Room	2	60	120				
2.	Drawing Hall	1	90	90				
3.	Physics Lab			75				
4.	Chemistry Lab			120				
5.	App. Mechanics Lab).		60				
6.	Electrical Engg. I	120						
7.	Unit Operation-I,I	I		120				
	Over Head Tank 20	Over Head Tank 2000 Litre Cap;						
	Under Ground Tank	600 Li	tre Cap;					
8.	Unit Operation-III	,IV		120				
9.	Automatic Process	Control	Lab.	75				
10.	Fertilizer Technol	.ogy/Pet	roleum	120				
	& Petro Chemical I	.ab.						
11	Computer Lab (Air and Special type p	Cond.Gl	ass Parti oring and	tion				
	false ceiling)			60				

[C] Work shop

I	Workshop	Supdt.	Room	12

II Store

III Shops

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(a)	Carpentry Shop	50
(b)	Smithy Shop	70
(C)	Fitting Shop	50
(d)	Welding Shop	50
(e)	Painting Shop	50
(f)	Sheet Metal ,Soldering & Brazing shop	50
(g)	Plumbing shop	50
(h)	Machine Shop	150
(i)	Foundry	75

[D] Student's Aminities

1.	Hostel	40	00	of	Strength	of	Students
2.	Cycle Stand	50	00	of	Strength	of	Students
3.	Canteen and Tuck shop	50					
4.	N.C.C. Room	70					
5.	Dispensary	40					
6.	Guest Room(Attached Bath)	45					
	incuding kitchen & store						

[E] STAFF RESIDENCES

1.	Principal	1	100	100
2.	Head of Department	1	100	100
3.	Lecturer	4	80	320
4.	Non teaching & Supporting	8	60	480
	staff			
5.	Class IV	6	30	180

Priorty to be given in following order

(1)

- a. Administrative Building
- b. Labs
- c. Workshop
- d. Over head Tank

- e. Boundary Wallf. Principal Residenceg. Fourth Class Quarters (2/3)

(2)

- a. Hostel
- b. Students Aminities

(3)

Residences of employee

LIST OF EQUIPMENTS

Only those of the equipments given below which are essentially required for the conduction of practicals mentioned in the curriculum are to be procured by the institutions.

"Machine/Equipments/Instruments of old BTE list which are not included below are to be retained in the Lab/Shop for Demonstration purpose but not to be demanded fresh for purchase."

NOTE : Equipment for different shop and lab of latest verson should be purchased.

S.No	.Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
1.	Brass ball with hook dia	2	50	100
2.	Stop watch least count Least Count 0.1 Sec. (non-megnetic) 0.01 sec to 0.001 sec	4	750	3000
3.	Wall bracket with clamping arrangement 8" to 10" length	2	50	100
4.	Meter scale Least count 0.1cm,wooden 1meter	5	40	200
5. 6.	Meter scale Least count 0.1cm,wooden 50 Cm Searl's conductivity apparatus	5	40	200
	with copper & steel rods 25 cm length 4 cm.diameter with all accessaries	2 set	1500	3000
7.	Constant Level Water Flow Container of one liter capacity vertical stand & rubber tubing	2	250	500
8.	Thermometer 0-110oC(Least count 0.1oC desirable)	4	100	400
9.	Potentiometer - 10 wires (1 meter length of each wire) with jockey, supmoical top	4	750	3000
10.	Moving coil galvenometer 30-0-30 with moving mounting	5	300	1500
11.	Rheostat 50 ohm.,100 Ohm.,150 Ohm. capacity	16	300	4800
12. 13.	Lead Accumulator 2V,6V (1 No.Each) Meterbridge 1 meter length, sunmica top copper strips fitted with scale	2 2	250 300	500 600
14.	Resistance Coil (Standard) 1 ohm. to 10 ohm.	10	50	500
15.	Moving coll ammeter U-1 amp., 0-2 amp., 0-5 amp. with mounting Moving coll voltmeter 0-1 V.,0-2V	8	250	2000
17.	0-5 V., 0-10 V. with mounting Denial cell	8 2	250 250	2000 500

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with complete accessories

S.Nc	Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs Aprox.
18.	Leclaunche Cell with complete accessories	2	250	500
19.	Standard Cadmium Cell	2	250	500
0.	Battery Charger	lset	1800	1800
. 1	with complete accessories	• • •		1 5 0 0
1.	Battery Eliminator Multi range	2set	750	1500
2.	Multimeter(Digital)	lset	800	800
3.	Carey Foster Bridge (With all accessories)	2set	4500	9000
4.	Resistance Box (2 No. Each) 0-1 Ohm, 0-100 Ohm.	4	850	3400
5.	Fractional Resistance Box 0-1 Ohm.	2	1200	2400
6.	Post office box Key type	2	1200	2400
7.	Post office box Dial type	2	1200	2400
8.	Resistance Wire(100 Gm.)	1 lacch	i 100	100
9.	Connecting Wire Copper(1/2 Kg.)	1 lacch	ii 700	700
<	Screw gauge L $c 1/100 \text{ mm}$	5eet	150	750
1	Vorpion Callinors I c 1/10 mm	5sot	100	500
1. 2	Approximation for determining abaracto	- -	100	500
2•	Appratus for determining characte			
	stics of P-N junction alode comple	ele	1 5 0 0	2000
2	with all accessaries	2 set	1500	3000
3.	Resonance Column of steel One Meter length and 3-4 Cm	2	1600	3200
	diameter fitted with scale & water level arrangement			
4.	App. for determining coefficient	a		
	(Complete with all accessories)	e 2 set	700	1400
5.	Tuning Fork's Sets Set of different frequency	3set	350	1050
6.	(With rubber pad) Physical balance with weight box Complete with Fractional weight	2	800	1600
7.	Anemometer with counter cup type	1	1000	1000
8.	Spring Force Constant Apparatus with graduated mirror & pointer,	2	1200	2400
9.	weight set with hanger Viscosity Apparatus (Stock law) with steel balls and	2set	1600	3200
0.	viscous liquid & timer Thermometer of different range	10set	100	1000
	Mercury thermometer 0-50oC to 0-110oC			
1.	Wall Thermometer Alcohal Filled 0-50oC	2set	20	40
2.	Sprit Level Technical Type	1set	60	60
3.	Drilling Machine Electric with different size	lset	800	800
и	DITS LDC Cae Burner with Culinder	100+	000	000
ч. 5	Tool Kit with different tools	iset	800	800
\smile .	TOOT WILL WILL WILL UTILETENIC COULD	TOCC	000	000

Complete 46. Lab stools

S.No.Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
 47. Lab tables 48. Plug Keys One Way 49. Plug Keys Two Way 50 Helical Springs - Soft, 10 cm each 	8 5 5 6	50 100 100	250 500 600

II. APPLIED CHEMISTRY LAB

S.No	D.Name of Equipment	No.	@ Rs. Aprox.	Amt.in Rs. Aprox.
1.	Test tube stand (Plastic/Tafflon)	30	20	600
2.	Funnel stand (Plastic/Tafflon)	30	20	600
3.	Burette stand	30	50	1500
	Stainless Steel/Wooden/Iron			
4.	Pipette stand	30	20	600
	Stainless Steel/Wooden/Plastic			
5.	Chemical balances with analytical			
	weights 1gm -200gms	5	1500	7500
6	Fractional weights set with rider	5 sets	25	125
•••	10 mg to 500 mg with rider	00000	20	120
7	Kipp's apparatus 1000 ml Plastic	2	500	1000
/ •	Tafflon	2	500	1000
0	Parganta battlag			
ο.	250ml	120	20	2400
		120	20	2400
		25	25	625 150
-		5	30	150
9.	Wide mouth bottle 250 ml Glass	50	15	750
10.	Winchester bottle 2.5 litre	15	30	450
	Plastic/Tafflon			
11.	Test tubes 1/4" x 6"			
i	. Corning or Borosil	200	9	1800
ii.	. Glass	200	2	400
12.	Boiling tube 1" x 6"			
i.	.Corning or Borosil	100	16	1600
ii.	. Glass	100	5	500
13.	Pestle and morter Dia 10 cms	2	30	60
	15 cms (Ceramics)			
14.	Watch glass 5.0 cms, 7.5 cms glass	15	5	75
1.5	Beakers (Glass/Brosil/Corning			
	Plastic)			
	250 ml	50	20	1000
	500 ml	50	20	1000
16	Weighing Tube 10 ml with lid	30	10	300
10.	(Plastic)	50	ΞŪ	500
17	(riascic) Wash bottlog (Dlastic/Tafflon)	20	15	450
⊥/. 10	Capical flack 250 ml Class	100	20 10	400
10.	(Descil/Couring/Disctic) Theorem	100	30	3000
1 0	(Brosil/Corning/Plastic) Transpart	10	4.0	<u> </u>
19.	Flat bottom flask 500 ml.Glass	15	40	600
20.	Flat bottom flask 250 ml.Glass	15	25	375
21.	Burette 50 ml. (Plastic/Tafflon)	30	60	1800
22.	Pipette 25 ml. (Plastic/Tafflon)	30	20	600
23.	Measuring flask 250 ml.			
	with stopper	30	50	1500
24.	Measring cylinder of various	12	30	360
	sizes (100 ml,250 ml,500 ml,1000 m	ıl)		
	3 no. of each			
25.	Bunsen's burner of brass	30	50	1500
26.	Gas plant petrol/LPG 10 to 20			
	burners automatic	1	5000	5000
27.	Spirit lamp (Brass)	30	30	900
28	Tripod stand (Steel/Iron)	30	30	900
	Large/Medium		20	
29	Wire gauge 15 X 15 cm with			
_ / .	ashestos	30	1 5	450
30	Tost tubo holdon woddon	50	10	500
50.	TESC CADE HOTAET MOUAGH	50	ΤU	500

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S.No.Name of Equipment	No.	@ Rs. Aprox	Amt.in Rs. . Aprox.
31. Porcelain plates Ceramic	30	20	600
32. Funnel 15 cm. Glass Borosil	60	16	960
Corning/Plastic			
33. Spatula hard & nickel/steel	2	each 50	100
34. Distilled water units (electrical)) 1	10000	10000
35. Distilled water units (solar)	1	5000	5000
36. Open balance 1000 gms./10 mg.	1	600	600
37. Brush for cleaning	100	10	1000
Hydro Fiber Acid & Alkali			
Resistant			
38. Jars 20 Lit. for keeping destilled	d		
water	5	100	500
39. Lab table 2 m. x 1.2 m. x 1 m. hig	ght		
with central sink and cup boards			
(Teak wood) with drawers and two			
built in almirah on each side with	r		
reagent racks, better tile top	4	8000	32000
40. Exhaust fans 18"	4	2000	8000
(GEC make/Crompton)			
41. Side racks and selves for bench			
reagents made of teak wood for 24			
bottels each set	4	2000	8000
42. Digital balance electronic	1	10000	10000
Electronics upto 2 decimal			
places			
43. Hot plates 7-1/2", 3" dia controle	ed		
2000 watts	1	1000	1000
44. Hot air oven thermostaticallv			
controled with selves and rotary			
switches 350 x 350 x 25 high	1	8000	8000
45 pH Meter (Digital)	1	1000	1000
46 Glass Electrode	2	850	1700
47. Reference Electro	2	850	1700
48. Weight Box 1gm, 2gmX2, 5gm, 10 gm			
20gmX2, 50gm, 100gm with for cep			
Miscellaneous	LS		15000

III. APPLIED MECHANICS LAB

Sl.No	Name of Equipment	No.	Rate	Amount
			1500	
1.	Polygon of Forces Apparatus	4	1500	60000
2.	Universal Force Table	2	2500	5000
3.	Principle of Moment Appratus			
	Bell Crank lever	4	1500	60000
4.	Combined Inclind plane &			
	Friction apparatus	4	1500	60000
5.	Simple wheel and axle	2	2500	5000
6.	Differential wheel and axle	2	3500	7000
7.	Double sleave Pulley Block	1	800	800
8.	Simple Screw Jack	4	3000	12000
9.	System of pulleys (Any I, II, III)	2Set	Each4000	8000
10.	Worm & Worm wheel	2Set	Each5000	10000
11.	Simply Support Beam with different	2	3000	6000
	weights (2 Sets)			
12.	Jib Crane	2	2500	5000
13.	Jointed Roof Truss Apparatus	2	2500	5000
	Misc.	Lum S	Sum	5000

Note :

S. No. 1,2 Acrylic/Wood material/Aluminium Cast
 S.No. 3,4,5,8,9 working model of Acrylic/Aluminium/Cast
 Above items are for 2 batches of 15 students each.

V. WORKSHOP PRACTICE

CARPENTRY SHOP

S.No	Name of Equipment	No		 (а	Rs.	Amt.in
Rs.	of Equipments	110	-	C	1.0.	- mil C • ± 11
	60 cm rule	10		 50		500
1. 2	Flevible steel rule 2 metre	2		75		150
2.	maguare 22 cm steel	10		7J 50		1JU 500
J.	Devel aguara 22 cm. steel	10		100		200
4.	Bevel square 23 cm. steel	10		100		200
5.	Marking knife 25 cm. steel	10		100		1000
6.	Marking gauge wooden & brass 25 cm	n.10		150		1500
1.	Mortise gauge wooden & brass 25 cm	n.10		150		1500
8.	Caliper inside,steel 20 cm.	2		200		400
9.	Caliper outside , steel 20 cm.	2		200		400
10.	Compass steel 20cm.	2		100		200
11.	Devider steel 20 cm.	2		100		200
12.	Plumb	2		75		150
13.	Wooden bench vice steel 20 cm.	10		500		5000
14.	Bench hold fast steel 30 cm.	10		300		3000
15.	Bar clamp 2 m.	2		500		1000
16.	G clamp of flat					
	spring steel 20x30 cm.	4		150		600
17	Rip saw 40-45 cm	10		200		2000
18	Cross cut saw $40-45$ cm	2		200		400
19	Tennon saw $30-35$ cm	10		200		2000
20	Dovetail saw 30-35 cm	2		150		2000
20.	Compass saw 35 cm	2 /		150		600
21.	Vou bala and an 20 25 cm	7		150		200
22.	Rey note saw or pad saw 30-33 cm.	2		200		300
23.	Bow Saw	2		200		400
24.	Frame saw	Z		200		400
25.	Chisel fish brand 1" to 1/8"	-		0 - 0		
	tirmer	3	set	250		750
	Dovetail	3	set	250		750
	Mortise	3	set	250		750
26.	Gauge or Golchi 1" to 1/8"	3	set	300		900
27.	Wooden jack plane complete	10		100		1000
28.	Wooden smoothing plane	10		250		2500
29.	Iron jack plane complete	10		200		2000
30.	Iron rebate plane complete	3		200		600
31.	Iron grooving plane complete	3		300		900
32.	Iron compass plane complete	3		350		1050
33.	Wooden moulding plane complete	3		500		1500
34.	Bradawl	3		350		1050
35.	Gimlet drills set	1	set	300		300
36.	Center bit	2		2.50		500
37	Twist bit	2		200		400
२.२ २.२	luger hit	2		200		100
30. 30	Dovetail bit	2		200		400
10 10	Countor shark hit	∠ ?		200		400
40. 11	Detabot brace machine	2		200		400
41. 40	Ratchet Diace Machine	2		300		1200
42.	Grand drill machine 1/4"	2		600		1200
43.	Wooden hand drill burmi	5		700		3500
44.	Wooden mallet	10		100		1000
45.	Claw hammer	3		100		300
46.	Carpenters hammer	10		100		1000
47.	Cutting tool for Universal wood	3	set	1500		4500
	working machine					
48.	Screw driver 18" & 15"	6		100		600

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S.No Rs.	.Name of Equipment	No.	ق ا	Rs. Amt.in
49.	Adze 500 gm.	10	100	1000
50.	Pincer 175 mm.	6	250	1500
51.	Plier 150 mm.	4	200	800
52.	Oil stone 8"	4	180	720
53.	Rasp file 12"	4	200	800
54.	Half round file 12"	4	200	800
55.	Round file 12"	4	200	800
56.	Triangular file 5", 4"	8	200	1600
57.	Water stone	4	80	320
58.	Carpentry work benches	4	4000	16000
59.	Band saw machine complete	1	60000	60000
60.	Circular saw machine	1	35000	35000
61.	Double Ended Electric Bench grinder	1	15000	15000
62.	Universal wood working machine	1	30000	30000
	misc. for foundation of machines	LS		20000
	SMITHY SHOP			
1.	Anvil 150 Kg. with stand	5	5500	25500
2.	Swage block $50 \times 30 \times 8 \text{ cm} \cdot \&45 \times 45 \times 10 \text{ cm}$.	2	3000	6000
3.	Hammers			
	Ball peen 0.8 Kg. (Approx.)	10	350	3500
	Cross peen 0.8 Kg. (Approx.)	10	350	3500
4.	Beak iron 25 Kg.	1	1000	1000
5.	Swages different types	6	100	600
6.	Fullers different types	6	100	600
7.	Leg vice 15 cms. opening	1	300	300
8.	Electric blower with motor	1	10000	10000
9.	Furnace chmney with exhaust pipe	5	10000	50000
10.	Sledge hammer - 5 Kg.	2	400	800
	Misc. tools		LS	5000
1	SHEET METAL, SOLDERING & BRAZING	5	100	500
2.	Trammel 1 m.	1	80	80
3.	Angle protector	5	100	500
4.	Try square 30 cm.	5	80	400
5.	Centre punch	5	50	250
6.	Steel rule 30 cm., 60 cm.,	5	25	125
7.	Sheet metal gauge	1	250	250
8.	Straight snips 30 cm.	2	500	1000
9.	Curved snips 30 cm.	2	600	1200
10.	Bench shear cutter 40 cm.	1	10000	10000
11.	Chisel 10 cm.	5	200	1000
12.	Hammer	5	300	1500
13.	Bench vice 13 cm.	5	2000	10000
14.	Plier	5	100	500
15.	Nose plier	5	120	600
16.	Sheet metal anvil/stakes	5	3500	17500
17.	Shearing machine 120 cm.	1	5000	5000
18.	Solder electric	2	1000	2000
19.	Solder furnace type	2	500	1000
20.	Brazing equipments and accessories	1	10000	10000
21.	Blow lamp	2	400	800

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22.	Sheet bending machine	1	20000	20000
	Misc.		LS	10000

FITTING SHOP

S.No.Name of Equipment Rs.	No.	Ø	Rs. Amt.in			
1. Bench vice jaw 10 cm.	10	600	6000			
2. Surface plate 45x45 cm.	2	4500	9000			
3. V. Block 10x7x4 cm.	5	700	3500			
4. Try square	10	100	1000			
5. Bevel protractor 30 cm.	1	250	250			
6. Combination set	1	3000	3000			
7. Divider	5	100	500			
8. Centre punch	5	80	400			
9. Calipers (Different sizes)	12	100	1200			
10. Vernier calipers 30 cm.	2	1500	3000			
11 Micrometer 0-25, 25-50 m m	4	1500	6000			
12 Vernier depth gauge	1	700	700			
13 Feeler gauge15 blades	1	100	100			
14 Radius gauge	1	200	200			
15 Angle gauge	1	200	200			
16 Thread gauge	1	200	200			
17 Bench drilling machine 13 mm	1	10000	10000			
18 Double ended electric grinder	⊥ 1	8000	8000			
19 Drill est	1 cot	2000	2000			
20 Popmor sot	100+	3500	2000			
20. Rediter Set	1 set	2500	3500			
21. Idp Set	1 set	1200	1200			
30 cm.)	Iset	. 1200	1200			
23. Allen key set	1set	700	700			
24. Spanners	6	100	600			
25. Work benches	6	4500	27500			
26. Power hacksaw	1	8000	8000			
Misc. Files, Dieset, Hexa frames	etc. 	LS	20000			
WELDING SHOP						
1. Ellectric welding set oil cooled	1	20000	20000			
cooled arc welder	1	25000	25000			
3 Air cooled spot welder 7 5 KVA	1	30000	30000			
4 General accessories for air cooled		50000	50000			
spot welder of 7 5 KVA			15000			
5 Gas welding set with gas cutting	torch		10000			
5. Gas werding set with gas cutting	1	20000	20000			
6 Migg work bonchog	1	JUUUU тс	35000			
0. MISC. WOLK DENCHES		22	33000			
PAINTING & POLISHING SHOP						
1. Air compressor complete with 2 HP						
motor	1set	25000	25000			
2. Spray gun with hose pipe	1	1500	1500			
3. Stoving oven	1	6000	6000			
4. Buffing machine with leather and	1	8000	8000			

cotton wheels 5. Electroplating Equipment for cromium 1 20000 20000

S.No Rs.	.Name of Equipment	N	ο.	<u>6</u>	Rs.	Amt.in
1. 2. 3. 4. 5. 6. 7. 8. 9.	Pipe vice 5 cm. Chain wrenches Ring spanner Set Wheel pipe cutter Water pump plier Pipe die set 2" set Pipe bending device Work benches Set of various types of plumbing fittings e.g. Bib cock Cistern, Stop cock, Wheel volve, Gat volve etc	4 5 2 4 2 1 4	500 500 250 600 100 set1200 5000 6500 LS		200 250 125 120 40 240 2600 400)0)0)0)0)0)0)0)0)0)0
10.	Misc. Hacksaw frame and others FOUNDRY SHOP		LS		400	00
1. 2.	Moulding boxes Laddles	25 5			120 20	000

2.	Laddles	5	2000
3.	Tool kits	10 sets	5000
4.	Quenching tanks water or oil	2	2000
5.	Permiability tester	1	2000
6.	Mould hardness tester	1	12000
7.	Sand tensile testing equipment	1	15000
8.	Portable grinders	1	6000
9.	Temperature recorders/controllers	LS	10000
10.	Pit furnace with Blower	1	10000

MACHINE SHOP

 The institutes running mechanical engg. course need not purchase these two items sepreately because they will have one complete machine shop for the course

2. Above items are for 2 batches of 15 students each.

INTRODUCTION TO COMPUTER (Common to all Trades)

COMPUTER CENTRE

S.No	. DESCRIPTION	QTY.	APPROX. COST	
1.	Core-2 Quad Processor, 4GB RAM 1 GB SATA HDD, 19" TFT Monitor/ Server of Latest Specification OS-Windows 2007/2008/Latest Versio	02 Server	(in RS.) 1,20,000=00	
2.	General Desktop Computer-Intel i5 or Higher(with latest Specification Pre loaded latest Anti Virus with Life time Subscription, Licence Media and Manual with UPS 660 VA with latest window OS Including licence OR	60 node on	36,00,000=00	
	Computer of latest Specification With latest window os including lice	nce		
3.	Software :((Latest Version)			
	i. MS OFFICE 2010/Latest Version ii COMPILER 'C', C++, JAVA-7		LS LS LS LS	
4.	Hardware	4,50	,000.00 LS	
	<pre>i. Switch-32 Port ii. Router iii. Hub iv. Ext. Modem v. Wireless N/W Adaptor vi. Series Access Point vii.LAN Cable Meter viii. LAN Cable Analyzer ix. Crimping Tool and all other accessories related Networking</pre>	to	02 02 04(8 Port) 02 02 02 05 05 15	
5.	Scanner- Flat Bed A4/Auto Lighter (Bit depth 48)		02 20,000	
6.	132 Column 600 CPS or faster 9 Pin dot matrix printer with 500 million character head life		02 50,000	
7.	Laser Jet-A4 All In one 20 page per min (2 Each)		04 50,000	
8.	Desk Jet-A4 Photo Smart (2 Each)		04 40,000	
9.	5 KVA on line UPS with minimum 30 minute battery backup along with sealed maintenance free batteries. Provision for connecting external batteries with network		04 8,00000	
connectivity.(For 2 Labs)

10.	Split Air Conditioner 1.5 tones capacity with ISI mark along with electronic voltage stabilizer with over voltage and time delay circuit	08 3	35,0000
11.	Room preparation and furniture	LS	
12.	19" rack, 24-port switch. connector RJ-45 Cat-6 cabling for network	LS	10,0000
13.	2 KVA Inverter Cum UPS	02	6,0000
14.	Fire Extinguisher (2 Kg.)	04	15000
15.	Fire Extinguisher (5 Kg.)	04	25000
16.	Vacuum Cleaner	02	25000
17.	LCD Projector 3000 Lumen with all Accessories	02	350000
18.	Pen Drive 16 GB	10	10000
19.	DVD Writer External	02	10000
20.	HDD External 500 GB	02	15000
21.	PAD (Latest Configuration)	02	15000
22.	Broadband For Internet(Speed Min. 8mbps)	04	LS
23.	USB Modem	02	8000
24.	Generator 15 KVA Water Coolant	01	450000

UNIT OPERATION LAB

Sl.N	Name of Equipment	No.	Rate	Amount
1.	Apparatus to verify Bernoulli's			
0	Thorem	1 set	15000	15000
2.	Apparatus for conducting			
	experiments on venturimeter with	1 co+	15000	15000
З	Revnold's apparatus with storage	I Set	13000	13000
5.	tank and flow steadying arrangement			
	with 1/2 HP pump and accessories	1 set	10000	10000
4.	Apparatus for determining Cc, Cv			
	and Cd (with set & micrometer guage)1 set	15000	15000
5.	Apparatus for determining various			
	head losses in pipes	1 set	25000	25000
	(Fitted with all valves & Orificeme	ter		
C	along with storage tank)	1+	12000	12000
0.	with v-type square-type notch	i set	13000	13000
7	Model of Reciprocating pump-1 4"	1	5000	5000
8.	Model of Centrifugal pump	1	5000	5000
9.	Pressure gauge Borden's type	1	5000	5000
	Max. 4 Kg/Cm2/1/4" connection Nipple	9		
10.	In place of item no. 1,2,4,5 & 8	6	20000	20000
	Hydraulic bench may be purchased			
	with all accessories or such			
	institution if already have above			
	items may purchase one unit,			
11	Otherwise 6 units			
±±•	tube Differential manometer and			
	minor equipments			20000
12.	Orifice Meter (Orifice Diameter 25mm)) 1	1000	1000
13.	Rota Meter	1	10000	10000
	40-400 lit. per. min. with all parts	5		
14.	Stop Watch (1/10 racer)	3	1200	3600
15.	Centrifugal Pump with Motor	1	15000	15000
	230 V, 1HP Single Phase	_		
16.	Plate & Frame filter Press	1		55000
	240X240 mm, 6 No. of Folter			
	Plate/5 Nos. of frame with			
	arrangement, filter cloth			
	& moterized gumg & tank			
17.	Sieve Shaker with Motor	1		7000
	& Time Switch/stop watch			
18.	Test Sieve with FHP Motor	1 Set		15000
	through a reduction gear			
	suitable to carry upto			
	7 sieve of 50 cm. or 20 cm.			
	diameter			
19.	Sieve Plate(S.S.) Distillation	1		75000
	Column			
	COLUMN dia 6-8" test size			
	20011111 dla with Keboller			
	and condenser			

Sl.N	No. Name of Equipment	No.	Rate	Amount
20.	U Tube Double Pipe Heat Exchanger	1		55000
	OD 25 mm, welded leak proff with			
	trip, all fitted on M.S. structure			
21.	Stainless Steel Spherical Jackted	1		50000
	Open Pan Evaporator.			
	1X4' with jacket for cooling stirrer	r		
22.	Stainless Steel Crystalizer	1		40000
	500 Lit. with stirrer motor			
0.0	and Gear Box	1		100000
23.	Rotatory Dryer	Ţ		100000
	1 5 M Dia 110 mm Feed Hopper			
	Product receiver, Heating Chamber,			
	Heater, Temperature Sensors,			
	Standard make on/off switch			
	Main indicator, etc			
24.	M.S. Thickner	1		45000
25.	S.S. Spherical Jackted Open Pan	1		50000
	Evaporator With Stirrer.			
	500 liter with Stirrer			
26	Motor and gear box Shell & Tube Heat Exchanger	1		50000
20.	System water ro water	1		50000
	(1-2 shell & tube type)			
	Shell : Material Stainless			
	Steel dia 220 mm, length			
	500 mm(Aprox.), Tube : OD			
	16 mm (Aprox.), Length			
~ -	500mm (24 Nos.)	-		
27.	Tray Dryer	T		70000
	Material Heater Temperature			
	Sensors Digital Temperature			
	Controller with standard			
	make on/off switch			
28.	Rotary Vacuum Filter	1		50000
	Drum Dia 1'-1.5 slurry through			
	vaccum/suction pump			
29.	Electric Bioler	1		80000
	with temperature control			
	recorder & pressure guage			
30	Disintegrator Alongwith	1		25000
50.	Wattmeter and voltmeter fitted with	1		20000
	Motor and stand, hammer type			
	Common guage plate input hopper			
	and discharge element (1 Horse Power	r)		
31.	Jaw Crusher alongwith Wattmeter	1		50000
	and voltmeter 4"X4" 40 kg. per			
	hour with 3 HP motor made of			
	heavy steel body with meganetic			
	SLEEL JAWS AND STAND			

Sl.N	No. Name of Equipment	No.	Rate	Amount
32.	Ball Mill Moc : MS	1		600000
	Chamber Size : 300(D) * 350 (L)	mm		
	Speed : 65 RPM with step pully a	arrangemen sholl	t	
	@ 50 cm high from the ground le	vel		
	2 hp ac motor, 1440 rpm, single	phase, 23	0V	
	& 50 Hz with step pulleus to gi	ve		
	Accessories : Set of Step pulle	ys &		
	Suitable belt 50 nos. 25 mm dia	proelain		
	Ball/ms balls 1 no. or product	collection h nainted		
	They of Sultable Size of HS with	n parneea		
33.	Vacuum Pump Water Ring Type	1		
34. 35	Vacuum Pump Oil Ring Type	1 1 Eac	h	
55.	Check, Butterfly, Steam	I Eac	11	
	trap, Safety valve, Ball valve.			
36.	Fittings (Flange, Socket,	1 Eac	h	
	Reducer, T, Plug)			
37.	Thermal Conductivity Meter	1		
	(For Asbestos Powder)			

AUTOMATIC PROCESS CONTROL LAB

Sl.N	Name of Equipment	No.	Rate	Amount
1.	Electronic Microprocessors Based Balance 300/310 Gm. Accuracy 0.001 gm., reproductibil	1 .ity		35000
	0.001gm, stabilization +3ppm/oC sample pan size 135mm dia, min.	na		
	Temperature range 0oC-40oC RH-85%, Power supply AC Adopter 2 or other +10%-15%, 50-60 Hz suppl	20V .ied		
	Acrylic wind shunt			
2.	Strip Chart Recorder	1		35000
3.	Automatic Rapid Moisture Tester.	1		32000
4.	Air Compressor (Single Stage) Single Phase	1		12000
5.	Aircompressor With Automatic Control Switch.	1		8000
6.	Bimetallic Thermometer	1		1500
7.	Stop Watch 1/10 sec. Magnetic 7 jwels	2		1500
8.	Platinum Resistance Thermometer	1		1500
9.	Thermo Couple With Indicator and Control Recorder	1		10000
10.	Recording Type Gas/Vapour Filled Thermometer (Single Pen)	1		9000
11.	Pressure Transducer With Indicato	or 1		16000
12.	Rate Meter 40-400 lit./min with all parts	1		10000
13.	Pneumatic Control Valve 1" twoway max, pressure 5kh. on/c (Diaphram Type)	1 off		8000
14.	Float & Tape Type Liquid Level Measuring Depth.	1		1500
15.	Flap or Nozzle Arrangement For Demonstration.	1		1000
16.	Pressure Regulator with Air Filter Niddle. (Max. Pressure 5 E 25 connector 1/4)	1 Bar		3000
17.	M.S. Tanks 1.5x1x0.7 M.	3		15000
18.	M.S. Tank Cylinderical With Inlet & Outlet type.	6		18000
19.	Bourdan Pressure Gauge	3		4500
20.	Tullo Pump of Minium Capacity 1/4 HP	3		15000
21.	Auto Transformer 2 amp	3		6000
22.	Voltage Stabilizer Input 80-280 V/Output 230 V	2		3000
23.	Millivoltmeter Milliameter Micrometer	3		24000
24.	Each U-100 Amp. Hot Plate Heater/Water Heater	2		6000

Sl.No	Name of Equipment	No.	Rate	Amount
1.	Red Wood Viscometer as per I.S.	1		65000
	1448 & I.P. 70 With			
	Stop Watch	1		
	Measuring Flasks (50 ML.)	1		
	Thermometers I.P.S.C.			
	Low Range Thermometer	1		
	Medium Range	1		
	High Range	1		
2.	Englier Viscometer As Per I.S.	1		85000
	434 & AS TM 490 with Stop watch			
	& Measuring flasks (200 to 240 M	.L.)		
	Thermometers ASTM 23oC			
	ASTM 24oC			
	ASTM 25oC			
3.	Saybalt viscometer ASTM 58 with	1		77000
	Stop watch and Measuring flask 6) M.L.		
	Thermometers ASTM 17oC			
	Saybalt ASTM 22oC			
	Saybalt ASTM 180C	-		
4.	Pensky Master Flask Point	1		36000
	Apparatus As Per I.P. 34			
	& 151448 closed cup types with			
	Thermometers I.P. 150C Low range			
-	I.P. 1600 High range	2		25000
5.	Cleave Land Flask & Fire Point	T		35000
	Apparatus as per 1.P36/6/			
	& ASTM D-92 open cup types with			
C	Thermometers I.P. 2000	1		16000
0.	T D 57 C T C 1449	T		40000
7	Appling Point Apparatus as por	1		32000
/ .	T P 2 with	T		52000
	Thermometer I P 2000 to			
	T P 21 oC			
	1.1. 21 00			
8	Cloud & Pore Point Apparatus	1		
•••	As per L.P. 15 & L.S. 1448	-		
	With Thermometer I.P. 1oC			
	(cloud & pore point)			
	I.P. 20C			
9.	Renstometer as per I.P 49	1		
	& I.S1448 with			
	Thermometer I.P38oC			
10	Photo Electric calorimeter	1		
11.	Hydrometer I.P. 160	1		
12.	Carbon Residue (Rans Bottom)	1		
	I.S. 1448 & 14/65			
13.	Carbon Residue(conradson)	1		
	I.P.13/42			
14.	Distillation of Petroleum	1		
	Product-I.P. 123/68			
15.	Colour by Lovibound Tinfometer	1		
16.	BOD Incubator	1		60000
	Temperature range 5-50oC uniform			
	cooling temperature uniformaity			

PETROLEUM & PETRO-CHEMICAL AND POLLUTION CONTROL LAB

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	+1oC opreating at 20oC, +1oC		
	Digital temperature indicator		
	And controller graduated in 1oC		
17.	BOD Bottle 300ml	1	4800
18.	Refrigerator	1	45000
	280 Lit., 180V-230V, 50 cycle		
19.	Laboratory Oven	1	42000
	2'X2'X2' thermometer, max		
	temperature 140 Degree C		
20	Laboratory Incubater	1	26000
20.	Temperature range 5-50oC uniform	-	20000
	cooling temperature uniformaity		
	+10C oprosting at 200C +10C		
	Digital tomporature indicator		
	And controllor graduated in 100		
0.1	And controller graduated in ioc	1	C0000
21.	Turbially Meter	Ţ	60000
	(Protable pen type with		
~ ~	a wide range of U-4000 NTUS)	1	0 5 0 0 0
22.	TDS Portable Meter	\perp	25000
	(Protable pen type with suitable		
	Probe)		
23.	pH Meter	1	15000
	(Protable pen type with suitable	Probe)	
24.	CNH Analyser	1	
25.	Ion Exchange Apparatus	1	
	(DM Water Pilot Plant)		
26.	Membrane Type Water	1	
	41		
	Purifier		
	Purifier CHEMICAL TECHNOLO	GY LAB	
1.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass)	GY LAB 1	350000
1.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type	GY LAB 1	350000
1. 2.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3"	GY LAB 1 1	350000 15000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S.	GY LAB 1 1 1	350000 15000 65000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With	GY LAB 1 1 1	350000 15000 65000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch	GY LAB 1 1 1	350000 15000 65000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.)	GY LAB 1 1 1 1	350000 15000 65000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C.	GY LAB 1 1 1 1 1	350000 15000 65000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer	GY LAB 1 1 1 1 1 1	350000 15000 65000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range	GY LAB 1 1 1 1 1 1 1	350000 15000 65000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range	GY LAB 1 1 1 1 1 1 1 1 1	350000 15000 65000
1. 2. 3.	Purifier Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with	GY LAB 1 1 1 1 1 1 1 1 1 1	350000 15000 65000 77000
1. 2. 3.	Purifier Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60	GY LAB 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	350000 15000 65000 77000
1. 2. 3.	Purifier Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC	GY LAB 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	350000 15000 65000 77000
1. 2. 3.	Purifier Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC	GY LAB 1 1 1 1 1 1 1 1 1 1 1 1 1 1 M.L.	350000 15000 65000 77000
1. 2. 3.	Purifier Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC	GY LAB 1 1 1 1 1 1 1 1 1 1 M.L.	350000 15000 65000 77000
1. 2. 3. 4.	Purifier Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 18oC Penety Master Flask Point	GY LAB 1 1 1 1 1 1 1 1 M.L.	350000 15000 65000 77000
1. 2. 3. 4.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Doparatus As Par I P. 34	GY LAB 1 1 1 1 1 1 1 1 M.L.	350000 15000 65000 77000 36000
1. 2. 3. 4.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 5 151448 classed sup types with	GY LAB 1 1 1 1 1 1 1 1 M.L. 1	350000 15000 65000 77000 36000
1. 2. 3. 4.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 & 151448 closed cup types with	GY LAB 1 1 1 1 1 1 1 M.L. 1	350000 15000 65000 77000 36000
1. 2. 3.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 & 151448 closed cup types with Thermometers I.P. 15oC Low range	GY LAB 1 1 1 1 1 1 1 1 M.L.	350000 15000 65000 77000 36000
1. 2. 3. 4.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 & 151448 closed cup types with Thermometers I.P. 15oC Low range I.P. 16oC High range	GY LAB 1 1 1 1 1 1 1 M.L. 1	350000 15000 65000 77000 36000
1. 2. 3. 4. 5.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 & 151448 closed cup types with Thermometers I.P. 15oC Low range I.P. 16oC High range Cleave Land Flask & Fire Point	GY LAB 1 1 1 1 1 1 1 M.L. 1	350000 15000 65000 77000 36000 35000
1. 2. 3. 4. 5.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 & 151448 closed cup types with Thermometers I.P. 15oC Low range I.P. 16oC High range Cleave Land Flask & Fire Point Apparatus as per I.P36/67	GY LAB 1 1 1 1 1 1 1 M.L. 1	350000 15000 65000 77000 36000 35000
1. 2. 3. 4. 5.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 & 151448 closed cup types with Thermometers I.P. 15oC Low range I.P. 16oC High range Cleave Land Flask & Fire Point Apparatus as per I.P36/67 & ASTM D-92 open cup types with	GY LAB 1 1 1 1 1 1 1 M.L. 1	350000 15000 65000 77000 36000 35000
1. 2. 3. 4. 5.	Purifier CHEMICAL TECHNOLO Distillation Apparatus (Glass) Sieve and Plate type Heating Mental-2"-3" Red Wood Viscometer as per I.S. 1448 & I.P. 70 With Stop Watch Measuring Flasks (50 ML.) Thermometers I.P.S.C. Low Range Thermometer Medium Range High Range Saybalt viscometer ASTM 58 with Stop watch and Measuring flask 60 Thermometers ASTM 17oC Saybalt ASTM 22oC Saybalt ASTM 22oC Saybalt ASTM 18oC Pensky Master Flask Point Apparatus As Per I.P. 34 & 151448 closed cup types with Thermometers I.P. 15oC Low range I.P. 16oC High range Cleave Land Flask & Fire Point Apparatus as per I.P36/67 & ASTM D-92 open cup types with Thermometers I.P. 28oC	GY LAB 1 1 1 1 1 1 1 M.L. 1	350000 15000 65000 77000 36000 35000

ELECTRICAL TECHNOLOGY & ELCETRONICS LAB

S.Nc	Name of Equipment	No.	@ Rs.	Amt.in Rs.			
1.	D.C. Shunt Motor 3 Kw. 1500 RPM with 3 Point Starter.	2	10000	20000			
2.	D.C. Compound Motor 3 Kw. 1500 RPM	2	10000	20000			
3.	Single Phase Transformer 1 KVA 50 Hz. Primary Voltage 230 with tapping at 50%, 86.6 % Facility	2	6000	12000			
4.	3 Phase Induction Motor 415 V., 50 Hz, 440 RPM, 3 KVA Star/Delta/Autotransformer Starter.	2	5000	10000			
5.	Loading Drum Spring Balance & Belt Arrangement.	2 Set					
6.	Tachometer (Analog/Digital)	1	2000	2000			
7.	3 Phase Inductive Loading of Variable Nature	1	8000	8000			
8.	Single Phase Inductive Loading Variable 0-10 Amp., 50 Hz.	1	8000	8000			
9.	Moving Coil Ammeter 0-10 Amp.	8	1000	1000			
10.	Moving Coil Voltmeter 0-300 V.	8	1000	8000			
11.	Moving Iron Ammeter 0-10 Amp.	8	1000	8000			
12.	Moving Iron Voltmeter 0-300 V.	8	1000	8000			
13.	Wattmeter Single Phase Dynamo Type 75/300/600 V. 2.5/5 Amp.	4	2500	10000			
14.	Three Phase Variable Inductive Loading.	1	8000	8000			
15.	Single Phase Variable Inductive Loading with Rheostat.	1	8000	8000			
16.	Megger 0-20 Mega Ohm, 500 RPM .						
17.	Flouroscant Tube With Choke.	1	100	100			
18.	SCR Bread Board	1	1000	1000			
	151 Corrected and Approved By BTE 04.05.2017						

19.	Power Supply 2	230 V.	1	1000	1000
20.	Moving Coil Ar	mmeter 0-500	M.A. 1	1000	1000

S.No	.Name of Equipment	No.	@ Rs.	Amt.in Rs.
21.	Moving Coil Voltmeter 0-250 V.	1	1000	1000
22.	Energy Meter Single Phase 230 V., 5 Amp	1	2000	2000
	Misc.		L.S.	1500

Sr. No	Particulars	Qty	Estimated Cost (Rs)
1.	Multimeter	1	17,000
2.	Power Analyzer	1	20,000
3.	Luxmeter	1	5,000
4.	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25,000
5.	Centrifugal pump, 1 kW	1	15,000
6.	Variable Frequency drive	2	50,000
7.	Water Flow meter	1	10,000
8.	Pressure Gauge	1	2,000
9.	Experimental Set up for Valve Throttling vs VFD	1	50,000
10.	Compressor, 20 cfm, single-stage	1	50,000
11.	Air leakage meter	1	18,000
12.	Blower (2 HP)	1	8,000

LIST OF LABORATORY EQUIPMENT(Energy Conservation)

LEARNING RESOURCE MATERIALS

1. 2.	LCD Projector with Screen Handicam	1 1	 20000 30000
3.	Cutting, Binding & Stitching equipment.	1	 30000
4.	Desk Top Computer with Internet Core i5/i7- 760, Processor, Genuine Windiw 7, Professional 18 inch HD, Flat Panel Monitor Optical Mouse, Key Board & all related media or latest version	1	 40000
5.	Home Theater Support Disc type CD. CDR/CDRW DVDR/DVDRW, VCD Supported with USB Port Support-DIVX/JPEG/MP3	1	 25000
6.	Commerical P A System 16 W-220W output, AC & 24V DC Operated, 5 Mic. & 2 Auxilary input, Speaker output 4 Ohm, 8 Ohm, 17 V & 100 V	1	 20000
7.	Interactive Board	1	 50000

ote :

1. This center will be only one at the institute level irrespective of all branches.

FORMAT FOR FIELD EXPOSURE

- 1. Name & Address of the unit
- 2. Date of

i. Joining.ii. Leaving.

3. Nature of Industry

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i. Product.
ii. Services.
iii. Working Hrs.
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- 4. Sections of the unit visited and activities there in.
- Details of machines/Tools & instruments used in working in the section of the unit visited.
- 6. Work procedure in the section visited.
- Specifications of the product of the section and materials used.
- 8. Work of repair and maintenance cell.
- Details of the shops (welding, Foundary, Machine shop etc) related to repair and maintenance work.
- 10. Name of checking and Inspecting Instruments and their details. Quality controls measures taken.
- 11. Details of hadraulics/pneumatic/ thermal units or appliances used if any.
- 12. Discripton of any breakdown and its restoring.
- 13. Use of computer if any.
- 14. Visit of units store, Manner of keeping store items, Their receiving & distribution.
- 15. Safety measures on work place & working conditions in general comfortable, convenient & hygeinic.

ANNEXURE - II

TRAINEES ASSESSMENT

This Institution invites the comments on the training of its students (work & behaviour) from their immediate

supervisors on the following points.

- 1. Name of the trainee
- 2. Date of
 - i. Joining.
 - ii. Leaving.
- З.
- i. Regularity & Punctuality
 - ii. Sense of responsibility
 - iii. Readiness to work/learn

iv. Obedience

- v. Skill aquired
- Name of the sections of the unit he attended during his stay. His activities/worth of being there.
- 5. Any thing specific

Sinnature of the Assessor

Date :-

Designation

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

- 1. Presentations of Case Studies
- 2. Debate competitions
- 3. Poster competitions
- 4. Industrial visits
- 5. Visual Aids

COURSE OUTCOMES

After studying this course, a student will be able to co-relate and apply fundamental key concepts of energy conservation and energy management in industry, commercial and residential areas. A student will be able to:

- Define principles and objectives of energy management and energy audit.
- Understand Energy Conservation Act 2001 and its features.
- Understand various forms & elements of energy.
- Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- Identify areas of energy conservation and adopt conservation methods in various systems.
- Evaluate the techno economic feasibility of the energy conservation technique adopted.

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

REFERENCE BOOKS

- 1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
- 2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
- 3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
- 4. Handbook on Energy Audit & Environmental Management by Y P Abbi&Shashank Jain published by TERI. Latest Edition
- 5. Important Links:
 - (i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. <u>www.beeindia.gov.in.</u>
 - (ii) Ministry of New and Renewable Energy (MNRE), Government of India. <u>www.mnre.gov.in.</u>
 - (iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. <u>www.upneda.org.in</u>.
 - (iv) Central Pollution Control Board (CPCB), Ministry of Environment, Forest and Climate Change, Government of India. <u>www.cpcb.nic.in.</u>
 - (v) <u>Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.</u>
 - (vi) Electrical India, Magazine on power and electrical products industry. <u>www.electricalindia.in.</u>

ANNEXURE-III QUESTIONNAIRE

INSTITUTE OF RESEARCH, DEVELOPMENT AND TRAINING U.P.KANPUR -208024

SUBJECT:	Questionnaire f activities of Engg.(Petrochemi	or ascertaini diploma cals)	ng the job y holder	potential and in Chemical
PURPOSE:	To design and d in Chemical Engg	evelop Threer .(Petrochemic	Year diplomals)	ma curriculum
NOTE:	1.Please answer the questionnair 2.Any other po questionnaire m enclosed with the	the questions e. int or sugges ay be written e questionnai	to the point tion not cove on a separative re.	ts given in ered in this te paper and
1.Name of	f the organisation	:		
2.Name & filling	Designation of the guestionnair	e officer e		
3.Name of shop	f the department/s	ection/		
4.Importe departr	ent functions of t	he		
5.Number under y Chemica	of diploma holder your charge in the al Engg.(Petrochem	employees area of icals)		
6.Please diploma	give names of mo a holder in Chemic	dern equipmen al Engg.(Petr	ts/machines l ochemicals)	handled by a
1.		2.		3.
4.		5.		6.
7.What p Chemica	proficiencies are al Engg.(Petrochem	expected fr icals)	om a diplor	ma holder in
1.		2.		3.
4.		5.		6.
8.Mentior Diploma	n the approximate ; a teaching.	percentage of	the following	ng desired in
1. Theo 2. Prac 3. Skil 9.Do you	oretical knowledge ctical knowledge Ll Development 1 think " on the	job training		% % rial training

should form a part of curs	(Yes/ No)			
(a) Duration of training				
(b) Mode of training	1. Spread over dif	ferent semesters		
	2. After completic	on of course		
	3. Any other mode			
10.What mode of recruitment	is followed by your	organisation.		
 Academic merit Written test Group discussion Interview On the job test. 				
11. Mention the capabilities diploma holder in Chemic (a) Technical knowledg (b) Practical skill (c) Etiquettes and beh (d) Aptitude (e) Health habit and s (f) Institution where	<pre>g/ Qualities looked cal Engg.(Petrochemi ge naviour social background trained</pre>	for while recruiting .cals) 		
12. Does your organisation h any system for the surve articles of different co	have ey of Home buntries/States.	Yes/No		
 13. Does your organisation of survey to know users vie 1. Home Articles for diage groups and sex. 2. Effect of climatic of 3. Any other If yes ; Please give 	conduct field ews regarding. Ifferent conditions e brief account of e	Yes/No each.		
14. Which type of assignment do you suggest for an entrepreneur in Chemical Engg.(Petrochemicals)				
15. In which types of organisations can a diploma holder in Chemical Engg.(Petrochemicals) can work or serve.				
1 2	3			
4 5	6			
<pre>16. Job prospects for Engg.(Petrochemicals) country.</pre>	the diploma hold the next ten years	ler in Chemical s in the state /		
17. In your opinion what sh diploma student in Cher	nould be the subject nical Engg.(Petroche	s to be taught to a micals)		
Theory	Practical			

18. Kindly mention particulars regarding topics/areas which should be given more emphasisin the curriculum .

Practical

Theory

- 19. Kindly state whether your organisation Yes/ No can contribute towards improvement of curriculum in above field. If yes : Please give names of experts in your organisation to whom contact.
- 20. Kindly give your valuable suggestions for being considered at the time of finilisation of curriculum.
- 21. What changes in technologies are to be incorporated in the development of curriculum in Chemical Engg.(Petrochemicals)

(Signature)

Kindly mail the above questionnaire duly filled to:-

Lal Ji Patel Text Book Officer Institute of Research, Development & Training, U.P. Govt. Polytechnic Campus Kanpur-208024 (Please note that all information in this survey is confidential for the use of curriculum design only)